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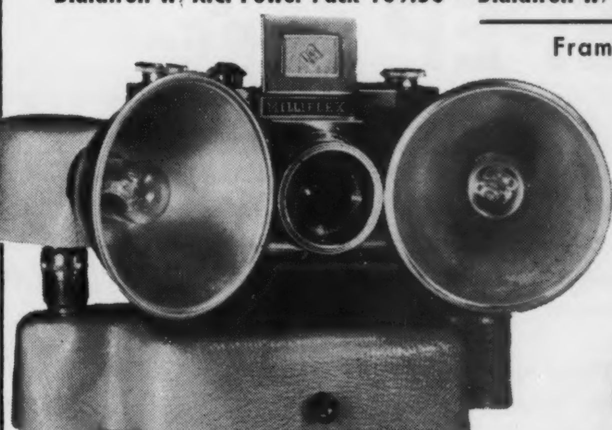

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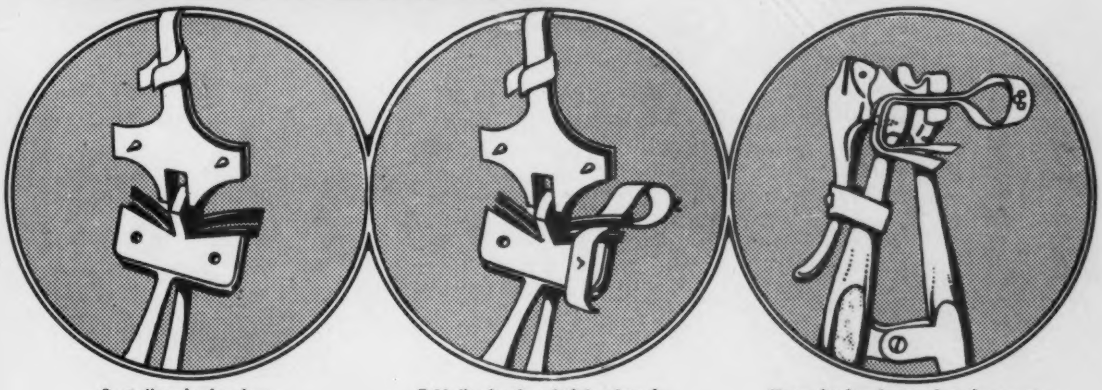

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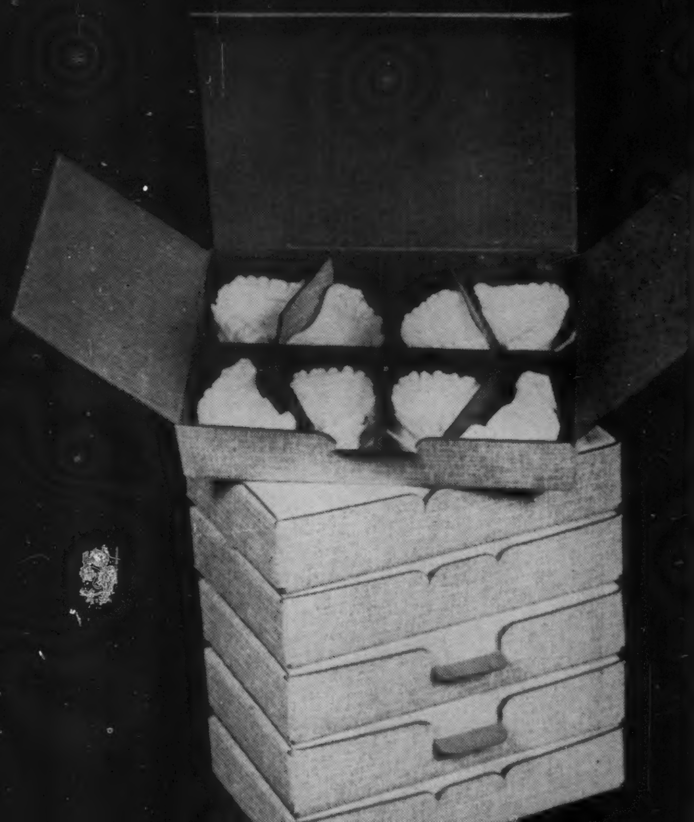

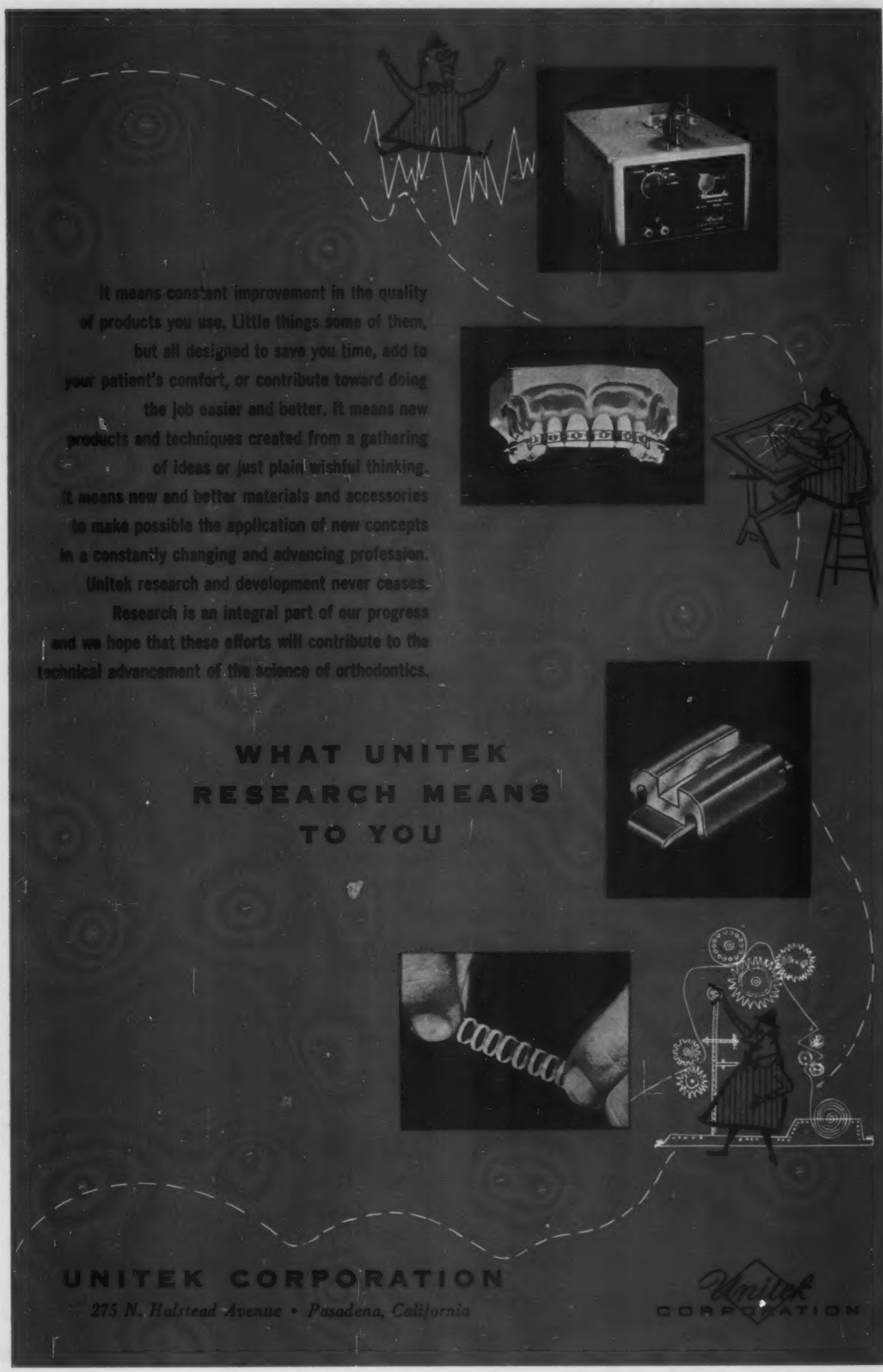
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American Journal of ORTHODONTICS

VOL. 42 MARCH, 1956 No. 3

Original Articles

PRESIDENT'S ADDRESS, MIDDLE ATLANTIC SOCIETY OF ORTHODONTISTS

B. EDWIN ERIKSON, A.B., D.D.S., WASHINGTON, D. C.

AT THE end of its fourth year of being, the Middle Atlantic Society of Orthodontists finds itself in a sound state of growth, able, with prudent administration, to take care of all its financial needs, and occupying a respected position in the family of constituents which make up the American Association of Orthodontists. This progress has not been accomplished without toil and anxiety; it is a tribute to the careful planning and sound judgment of the Society's first officers, Drs. Anderson, Patton, Sheridan, and Devlin, as well as its first director, Dr. Rosenast. This is not to say that these men were working alone at the task of laying our foundations; they enjoyed a degree of confidence which brought forth the unified and enthusiastic effort of many others that characterized that first year of our existence.

In the minds of some of us, one of the main considerations involved in our segmentation from our valued neighbor, the Northeastern Society, was to be able to realize those simple and leisurely scientific programs that encourage open and helpful discussions, and which seem to be found only in a small organization. So far our programs have been of that nature, and Dr. Lloyd has aimed to maintain it in the program for this year, keeping in mind that as we grow the possibility may not rest with us permanently.

During the year we have held three meetings of the Executive Council, about which Dr. Deems undoubtedly will report later in the reading of his minutes. However, I wish to mention here that at the first of these we took

Presented before the Middle Atlantic Society of Orthodontists, Shoreham Hotel, Washington, D. C., October, 1955.

action to implement some of the recommendations made last year in the presidential address of Dr. Sheridan. To elaborate, the Council authorized the appointment of a temporary Convention Planning Committee pending the adoption of a constitutional amendment which would place such a committee on a basis with our elected rotating committees. The editor, Dr. Hopkins, was suggested as the appropriate officer to commence the work of recording our Society's history, and I believe that he has already compiled a considerable mass of data in that direction. The printing of the constitution was considered, with the collective judgment to defer it for the present.

In San Francisco last May the American Association of Orthodontists adopted an amendment which may have far-reaching effects on the course of development of our specialty. I refer to the amendment defining the qualifications for membership in the A.A.O. As passed, this amendment will, in the future, limit our membership to alumni of the graduate departments of universities. While not saying so specifically, the practical effect of this amendment may be to abolish preceptorship as a means of teaching the future orthodontist. Is this effect altogether desirable? Will orthodontists of mature experience challenge the assertion that the creditable treatment of run-of-the-mill orthodontic cases, like creditable performance on the golf course, is learned not from textbooks and treatises but from actual performance over and over again? If we abolish preceptorship, will the young orthodontist be as effectively guided clear of the many pitfalls that are likely to beset him in his early years? If he is not so guided, it would seem that he is doomed, for a few years at least, to the experience encompassed in the words of Santayana: "Those who cannot remember the past are doomed to repeat it."* For the neophyte orthodontist there is no past, so he must traverse the same ground that has been covered repeatedly by his predecessors, exposing himself to blunders from which he might be saved by timely guidance.

Conceded, there is another side to the argument for or against preceptorship, but let us not lightly lose sight of the advantages offered by qualified preceptorship for the most effective training of the young orthodontist.

The amendment that we are discussing was passed by a rather close vote at a meeting held on the Pacific Coast, at which possibly the predominant opinion may have failed to represent a cross section of the opinion of the country at large. A measure affecting so drastically the training of the future orthodontist should, it would seem, receive the considered evaluation of every single active member of the A.A.O. as now constituted. With that end in view, it might be wise to reconsider the whole matter at the next meeting of the A.A.O., which will be held on the East Coast.

Customarily, a report of this nature contains recommendations for improvement of administrative proceedings of the Society. I have none of a positive nature to make and this fact, I believe, is a tribute to the original committee, headed by Dr. Shehan, which drew up our constitution. The A.A.O. amendment relating to eligibility will necessarily be incorporated into

*Quoted by Frank B. Berry, M.D., Assistant Secretary of Defense (Health and Medical) in the *U.S. Armed Forces M. J.*, July, 1955, not however, in endorsement of preceptorship.

our own constitution. As soon as this amendment has stood the test of acceptance by a stable majority of the A.A.O., the time perhaps will have arrived when our constitution should be put into printed form. In the meantime, consideration might well be given to our method of nominations. Under the constitution as it now stands, the Executive Council acts as a nominating committee for candidates for elected committees, while candidates for the vastly more important Executive Council are nominated from the floor only. It would seem that so long as we preserve the democratic right of additional nominations from the floor for any and all elected offices, the Executive Council might well be constituted as a nominating committee for all elected positions. Actually, its nominations would be only recommendations, in any event.

In closing, I wish to thank all the committees that have contributed to the Society's functioning over the past year. Each and every individual member of the Executive Council has contributed his part in carrying on the administrative affairs of the Society and, to each, I wish now to express my thanks. Dr. Paul Deems, our new secretary, has assumed the varied and burdensome duties of his most important office with calm confidence and has discharged them with orderly efficiency. To our first president and present chairman of the Board of Censors, Dr. George Anderson, and to our first secretary and present alternate director, Dr. Gerard Devlin, I wish to acknowledge their willingness always to assist me with advice and guidance in the many instances in which I have called upon them in reaching decisions in administrative matters. Of the chairman of the Program and Local Arrangements Committee, Dr. Z. Bernard Lloyd, I can hardly say enough in recognition of his contribution to the meeting. The fact is that without a good program chairman there is no meeting. And finally, to the membership as a whole, for the very great honor of serving as your president, I wish to say, borrowing a phrase, thanks and thanks and ever thanks.

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THE TREATMENT OF EXTRACTION CASES USING A MODIFIED JOHNSON TWIN ARCH WIRE TECHNIQUE

Faustin N. Weber, D.D.S., M.S.,* Memphis, Tenn.

INTRODUCTION

EVER since Joseph E. Johnson reported his twin wire appliance to the profession in November, 1933, an increasing number of orthodontists have been attracted to its use. This is so because of the excellent clinical results which Johnson has been able to show with its use, and also because of the versatility of the appliance and its ease of operation.

During the past twenty-two years, the period encompassing the introduction and widespread acceptance of the Johnson twin wire appliance, extraction of teeth in the treatment of malocclusion has become a widely accepted practice, and orthodontic treatment techniques have been greatly modified to make it possible to manage adequately those malocclusions that required the extraction of one or more permanent teeth. The conventional treatment techniques that were used during the nonextraction era had to be altered to adapt the appliances to the demands of the type of treatment in which teeth were removed. This was true regardless of whether the appliance technique used was labiolingual, edgewise, universal, or twin arch wire. And so each operator improvised and, using the appliance of his choice, developed a technique which enabled him to treat the extraction case.

Improvisations that have been used with varying degrees of success in treating extraction cases with the Johnson twin arch wire are presented in this paper. Some of these improvisations are original; the majority, however, are borrowed from other men. Since it is impossible to trace the origin of most of these various technical innovations back to their originators, credit cannot be given to those who deserve it, much as this is desired.

INITIAL TREATMENT PROCEDURES

To give this material coherence, it will be presented in chronological sequence, relating the appointment-by-appointment procedures that are used in treating an Angle Class I, four-premolar extraction case.

The initial appointment is devoted to a collection of the data that are necessary to make the diagnosis and plan the treatment. Before this first appointment, however, the patient has already visited his dentist to have all

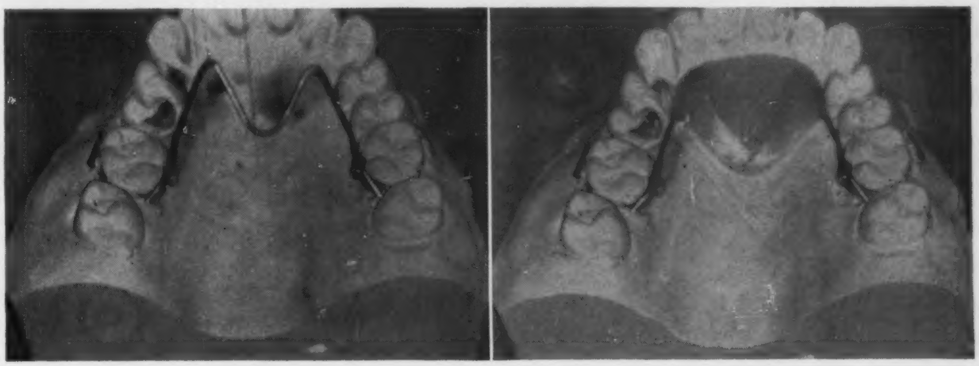
Presented before the Middle Atlantic Society of Orthodontists, Washington, D. C., Oct. 6, 1955, and the Southwestern Society of Orthodontists, Wichita, Kansas, Oct. 17, 1955.

*Professor and Head of the Department of Orthodontics, University of Tennessee.

the necessary dental restorations inserted, the full-mouth roentgenograms made, and the dental prophylaxis given. At his first orthodontic appointment, impressions are taken, cephalometric roentgenograms are made, clinical photographs are taken, separating wires are inserted in the molar regions, and the clinical examination chart is filled in.

Between the first and second appointments, the orthodontic diagnosis having been made and the treatment planned, the patient is sent back to his dentist for extraction of the four first premolars.

On the second appointment molar bands are fitted. The Johnson loop molar bands are used. These are pinched to fit the molar teeth; they are then removed to be soldered and to have vertical half-round tubes fastened to their lingual surfaces before being replaced on the teeth. Alginate impressions are made with these bands in place. The bands are removed from the teeth, fitted into the impression, and waxed in position. The working models, which are poured from these impressions, provide accurate casts upon which the upper and lower appliances are constructed.



A. *B.*

Fig. 1.—*A*, The form of the palatal appliance. *B*, Application of the quick-curing acrylic to form a palatal button.

Between the second and third appointments two lingual arch wires are made—one on the maxillary working model and one on the mandibular working model. Great care is exercised to get proper adaptation of the lingual arch wires. This is important because, as you will observe in the technique that is to be described here, a great portion of the intraoral anchorage is derived through the use of these lingual appliances. The maxillary lingual appliance is of a nonconventional design (Fig. 1, *A*) and has a button, made of quick-curing acrylic, attached to its anterior portion (Fig. 1, *B*). This acrylic button fitting in the anterior palatal vault contacts the thick dense and fibrous mucous membranes of the palate, posterior and superior to the maxillary anterior teeth. The arch wire is not tooth-borne except for the connection that it has with the molar bands. It derives a great deal of its stability from the intimate relationship that exists between the tissues of the anterior palatal region and the palatal acrylic button. The anchorage possibilities of this

appliance are enhanced in the patient who has a deep palatal vault; it is less effective in the patient with a flat, broad palatal vault. The acrylic button that is attached to the upper lingual arch wire is a useful auxiliary to augment the anchorage of the maxillary dental arch in most extraction cases because, more frequently than not, the form of the palatal vault of these cases is such as to make the button effective in stabilizing the posterior teeth against any forward displacement while moving the anterior teeth distally and closing the extraction spaces. The broad, flat palatal vault form is typically associated with the wide, well-developed maxillary dental arch and usually is not the type of dental arch from which teeth need be extracted as a part of orthodontic therapy.

In the mandibular dental arch the lingual arch wire is entirely tooth-borne. The adaptation of this appliance to the cervicolingual portion of the crowns of the mandibular incisors is such as to bring these teeth into the anchorage unit and to help prevent the posterior teeth from moving forward as the canines are being retracted. Efforts to use an acrylic button on the mandibular lingual appliance to reinforce the anchorage, as is done in the maxillary arch, have proved unsuccessful. The gingival tissues lingual to the mandibular incisors are thin and lack the fibrous character of the tissues in the anterior palatal area; therefore, they do not tolerate the application of pressure as well as do the tough, fibrous tissues in the anterior palatal region.

At the third appointment, the molar bands are cemented to place. The upper and lower lingual arch wires have already been made on the working casts, but are not inserted until later.

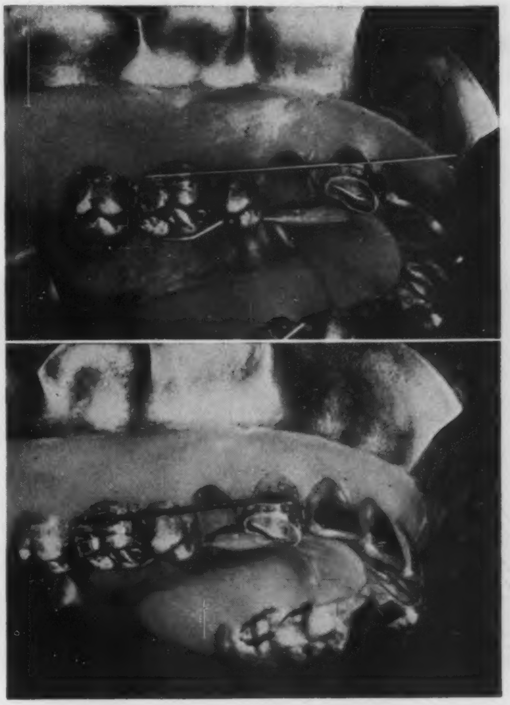
At the patient's fourth and final visit in this initial series of appointments, bands are made and cemented to the four canines. Recently we have used stainless steel preformed bands with the Johnson locks attached. These bands, with an 0.004 inch thickness, are thin enough to be fitted on almost any tooth without providing prior separation unless the contacts are exceptionally tight.

Canine Band Positioning.—In locating the bands on the canines, particular care is taken to do several things. The lock is located off-center of the labial surface of the crown of the tooth, mesiodistally considered, and the incisal and cervical edges of the band are not placed at right angles to the long axis of the tooth. The band is driven more cervicalward at the distal portion of the cuspid crown than at its mesial portion, and the Johnson lock is located in the distal half of the labial surface. These two precautions are taken in an effort to prevent the maxillary canines from rotating and tipping to an undesirable extent as they are moved distally. All clinicians have observed that as canines are moved distally there is a tendency for the distal surfaces of their crowns to rotate lingually and the crown portions to tip distally. This leaves these teeth tipped and rotated after they have been moved distally. Offsetting both the band level and the position of the lock on the canine will help to overcome these undesirable aspects of tooth movement.

Another caution to observe concerns locating the canine band in a vertical plane. The shape of the upper canine often demands that the band be placed high on the crown of the tooth in order to have a well-fitted band. When this is

necessary, a bayonet bend is placed in the tubular portion of the sectional arch wire to put its vertical position level with the bracket and avoid a downward pull that would move the tooth into a supraverted position as it is carried distally by the sectional appliance.

A.



B.

Fig. 2.—*A*, The sectional appliance before the ribbon arch wire is cut to proper length and the cap placed on the canine band. *B*, The ribbon wire portion of the sectional arch wire locked to the attachment on the canine band. The ribbon wire has been cut to appropriate length and its end bent toward the tooth.

Sectional Arch Wires.—After the canine bands are cemented in the positions described, the upper and lower lingual appliances are inserted. To complete the appliance assemblage, sectional arch wires are placed in all four quadrants of the mouth. These are made by drawing a flat, ribbon-shaped wire (0.010 by 0.022 inch) into tubular material such as is used in the construction of a conventional twin arch wire. The ribbon wire that is drawn into the end tubing and, with it, comprises the sectional arch wire is used in preference to two round wires that are usually drawn into the end tubing because of the flat wire's resistance to bending on its wide dimension (Fig. 2, *A*). With the ribbon wire fitted into the Johnson lock so that its wide dimension is in a vertical plane, a minimum of tipping of the canines is allowed as they are moved posteriorly with these sectional arches. The flat ribbon wire portion of the sectional arch wire is cut to a length that is only slightly in excess of the mesiodistal length of the Johnson bracket. The end tube, or tubular portion of the sectional arch wire,

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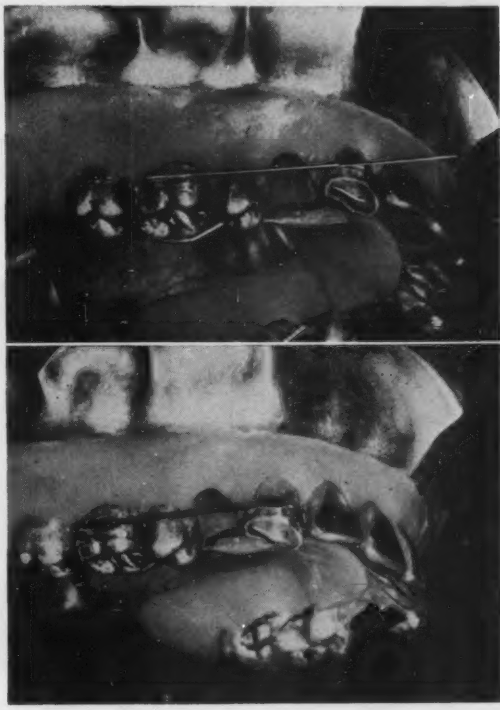

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extends from a point close to the distal portion of the bracket on the canine band back to the posterior end of the buccal tube that is soldered to the molar band. The anterior end of the ribbon arch wire that protrudes beyond the mesial portion of the canine bracket is bent close to the labial surface of the tooth to prevent the sectional arch wire from slipping posteriorly through the bracket and to make the appliance nonirritating to the lips (Fig. 2, *B*).

The cap is placed on the bracket and the ribbon wire portion of the sectional arch wire is locked in position. These sectional appliances are activated by coil springs or rubber elastics. In this technique elastics are used more often than coil springs. The elastics of choice are the thin-walled latex rubber variety, ¼ inch in diameter. In most cases these elastics deliver between 1 and 2 ounces of force when stretched from the distal side of the buccal tube on the first molar to the anterior side of the canine bracket (Fig. 3). In noncooperative patients,

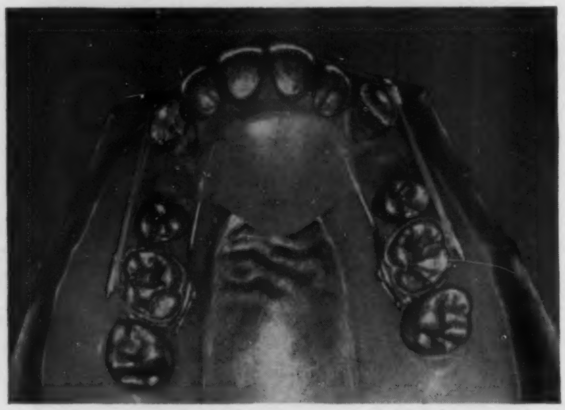


Fig. 3.—Palatal appliance with acrylic button attached. Sectional appliances are shown that are activated by elastics stretched between the canines and molars.

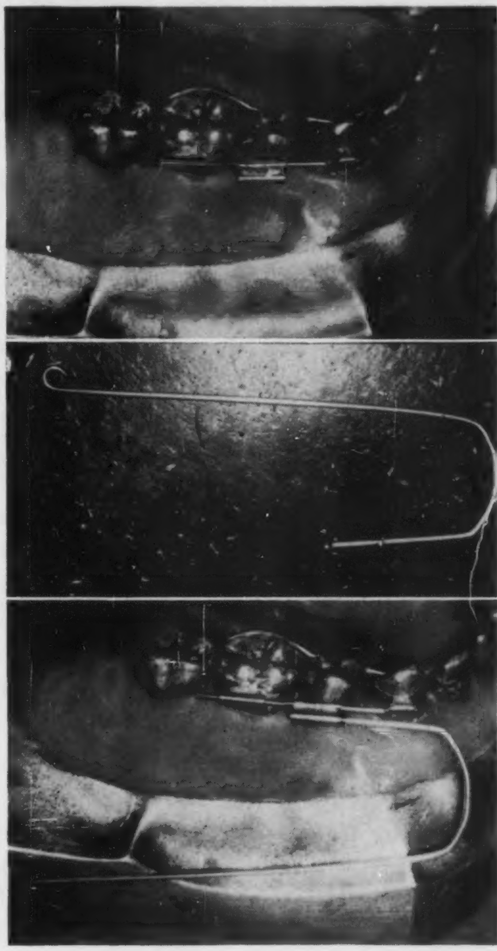
who cannot be depended upon to wear elastics faithfully and to change them regularly, a coil spring section may be used over the tubular part of the sectional arch wire. The coil spring is formed from hard-temper stainless steel wire, 0.009 inch in diameter, wrapped on a core 0.032 inch in diameter. A length of the coil spring is slipped over the tubular part of the sectional arch wire and compressed between a stop that is placed in the tubular material approximately 4 mm. in front of the point where it fits into the buccal tube and a ligature wire that is wrapped around the tubing at the mesial end of the end tube. One end of the ligature wire is cast around the posterior end of the buccal tube, and as the two ends of the ligature wire are twisted together the coil spring being compressed thus is activated to put a distal pulling force on the canine.

This is a most efficient appliance, and great care must be exercised in its use lest too much force be exerted on the canine. Excessive force crushes the periodontal membrane at the alveolar crest on the distal side (that is, the pressure side) of the root of the canine, and makes the tooth behave as a two-armed lever with the crown tipping distally and the root apex mesially as the tooth is moved posteriorly.

As the canines are moved into position with the action of the sectional arch wires, the anchorage units must be watched carefully to observe any tendency which they may have to yield to the forces directed against them.

Extraoral Anchorage.—If the anchorage begins to slip, extraoral anchorage may be used to complete the posterior movement of the canines with or without continuing the use of the intraoral anchorage.

The type of extraoral anchorage that we use most frequently is cervically derived. An adjustable elastic strap fitted to the patient's neck furnishes the pull against the canines needed to move them distally. Attachment from the



A.

B.

C.

Fig. 4.—*A*, Double tubes joined and fitted over end tube of the sectional appliance to receive commissural hook for application of extraoral force. *B*, Commissural hook fabricated from 0.045 inch chrome alloy wire. Curved end receives headgear or cervical strap. *C*, Commissural hook fitted into one of the joined double tubes. A stop prevents the joined tubes from sliding distally.

elastic strap to the sectional arch wires is made by means of two pieces of 0.045 inch stainless steel wire, which are fastened to metal fixtures on the ends of the neck strap and then pass into the mouth at the commissure. Each commissural hook fits into one of a set of two buccal tubes that are soldered to-

gether (Fig. 4, *A, B,* and *C*). The other buccal tube of this set is fitted over the end tube of the sectional appliance and is prevented from sliding distally, except as the whole sectional arch moves distally and carries the canine with it, by a stop that is placed in the sectional arch wire just distal to these joined tubes.

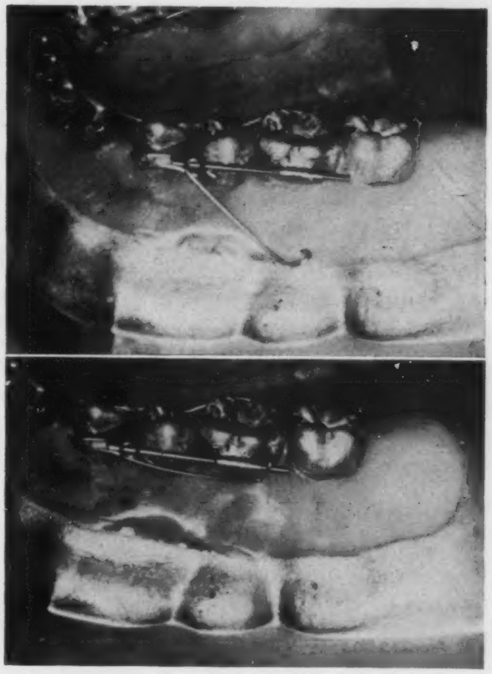
Movement of Canines.—Distal movement of the maxillary canines is usually started before that of the mandibular canines. This is done to avoid any tooth interference that might result from the more rapid posterior movement of the mandibular canines. However, even though no direct force is used to move the mandibular canines at this initial period of treatment, they are allowed to shift distally around the arch wire after the first premolars have been extracted. With the mandibular lingual arch wire in place, and with stabilizing wires contacting the mesial surfaces of the second premolars, there is no chance of the posterior teeth's shifting forward but every opportunity is offered the mandibular anterior teeth to adjust their positions. Under these circumstances, favorable natural adjustments occur which consist of the posterior movement of the mandibular canines and the lateral shifting of the mandibular incisors. The cumulative effect of this tooth shifting is one of improving the positions of all the mandibular anterior teeth while holding the posterior teeth in their original satisfactory Class I occlusal relations. Moreover, this favorable shifting of teeth places no strain on the mandibular anchorage, but preserves it until it must be employed when the mandibular sectional appliances are put into active use to effect most of the distal movement of the canines. In allowing this natural adjustment of the mandibular anterior teeth to take place, care must be exercised that the canines do not move distally to the extent that they become tipped into undesirable axial relationships. The danger of this happening when the canines are upright, or when their crowns are inclined distally, is so imminent that it is inadvisable to allow anything but positively controlled movement of the canines in such cases. This means that the mandibular sectional arch wires, like the maxillary ones, must be placed immediately after the premolars are extracted.

The first stage of the treatment is completed when the four canines have been moved distally into contact with the second premolars. This usually requires four to six months of treatment. At this point, or even earlier, the axial relationship of the canines should be critically appraised. It is possible that one or more of the canines will not be as upright as is desirable and, if this is true, the vertical relationship of the tipped canines can be improved by the addition of an uprighting spring. This is made by soldering a piece of 0.022 inch gold wire to the cap that fits on the Johnson lock of the canine band. Immediately distal to the cap the wire is bent through 360 degrees to form a small "safety pin" loop (Fig. 5, *A*) and then is extended posteriorly to hook over the end of the tubular material which projects out of the distal end of the buccal tube (Fig. 5, *B*). In its passive, unengaged position this uprighting spring lies on the cervical side of the buccal tube. Uprighting the canines and moving them distally at the same time is possible. Therefore, it is advisable to add these up-

righting springs to the canines just as soon as it is found that they are assuming an unfavorable axial relationship while they are being moved distally.

Alignment of Incisors.—After the canines have been moved into contact with the second premolars, bands are cemented on the upper and lower incisors and their alignment is started. During the time the canines are moving distally, space will open between adjacent incisors. When the contacts are open, band fitting on the incisor teeth is simplified, and therefore it is delayed until this stage of treatment is reached. The upper incisors are fitted with bands carrying the Johnson lock; the lower incisors are fitted with bands carrying the twin-tie attachment. The purpose of employing twin-tie attachments on the lower incisors is to make it possible to use heavy-gauge, round wires, as well as the conventional twin arch wire, in the mandibular arch. In the maxillary arch only the Johnson twin wire appliance is used after the sectional arch wires are discarded.

A.



B.

Fig. 5.—*A*, Uprighting spring (0.022 inch gold alloy wire) soldered to the cap on the canine to use in tipping the crown mesially and the root apex distally. *B*, Uprighting spring locked in its working position.

The vertical level of the attachments on the banded upper and lower incisor teeth is the same as the level of the attachments on the canine bands. This is done to compel all the upper and lower anterior teeth to assume a common vertical plane. To help in the proper vertical location of each bracket, a pair of dividers is used at the time the anterior bands are being made and then again at the time these bands are being cemented in place. The mesiodistal location

of the attachment on the crown of the tooth depends, of course, on their possible need of rotation. Nonrotated teeth have the attachments on their bands located centrally; rotated teeth have their attachments located off-center, toward the side which needs to be turned labially.

The Labial Arch Wires.—Full labial arch wires in both dental arches are used next. These appliances are employed first to affect the correction of any rotated teeth and to "level off" the anterior teeth. These objectives are accomplished by the use of the Johnson twin arch wire in both dental arches or, if one prefers, an 0.016 inch round stainless steel arch wire may be used in the mandibular arch. This arch wire is the one of choice if first molars or second premolars need to be uprighted from tipped positions. In such instances, bands with twin-tie attachments are used on the premolars as well as the mandibular incisor teeth. In order to make the 0.016 inch wire fit snugly into the buccal tubes that are attached to the molar bands, 3/8 inch of the arch wire at both ends is bent sharply upon itself. This produces an arch wire with ends that are 0.034 inch to 0.035 inch in diameter. These heavy ends fit with close tolerance into the buccal tubes. The arch wire is then ligatured into the twin-tie attachments of all the other mandibular teeth that are banded. Following the use of 0.016 inch mandibular arch wire or the mandibular Johnson twin arch wire, 0.020 inch and finally 0.022 inch round chrome alloy wires are generally employed. The ends of these wires are finished by being fitted into short lengths of end tubing. The wires are attached to these tubes by welding them while they are in the lumen of the tubular material. When in place, the finished arch wire has a length of end tubing at both ends that extends from the distal surfaces of the molar buccal tubes to the distal surfaces of the second premolars, if these teeth have been banded, or to the distal surfaces of the mandibular canines if the second premolars are unbanded. The middle section of 0.020 inch or 0.022 inch chrome alloy wire is seated in the twin-tie attachments and locked in place with 0.010 inch ligature wire. To insure complete seating of the arch wire in the attachment, ligature-tying pliers are used to fasten each ligature.

At the stage of treatment when the 0.016, 0.020, or 0.022 inch round arch wires are in place in the mandibular arch, the lower lingual appliance is unnecessary and usually is removed. This is certainly the case if the molars are tipped and the action of the labial appliance is expected to upright them, or if any mesial or distal movement of the molar teeth is desired.

When the maxillary canines are in place and the full arch wire replaces sectional arch wires, the lingual appliance is altered by the removal of the acrylic button. This is done easily and quickly by burning it off. The maxillary lingual arch wire thus altered may be used further, provided that no mesial or distal movement of the first molars is desired. If the appliance is kept in place, extensions are soldered to it and are brought out labially to contact the mesial surfaces of the canines. Such extensions are effective for holding the canines in their distal relationship while the incisors are being retracted and the space between them closed.

Closing Anterior Spaces.—Space closure in the incisor area is the next step in the list of treatment procedures. At this stage, if the second premolars have not already been banded to help in uprighting the molars or to rotate the premolars themselves, they are usually fitted with bands that carry twin-tie attachments. The design of this attachment is such that effective bracket engagement between it and round wires as small as 0.016 inch or as large as 0.036 inch can be effected by tying them in place, using ligature-tying pliers to secure the ligatures.

If the second premolars are rotated or tipped to such a marked degree that correction of their malpositions cannot be managed efficiently by ligating them to the labial arch wire, a rotating or uprighting spring is fitted into one of the two channels in the twin-tie attachments through which the ligature wire is usually passed. Such springs are used until the tipped or rotated teeth have been corrected to an extent that makes it possible to get reasonably good bracket engagement and to complete their correction by ligating them to the arch wire. These springs are formed from chrome alloy wire, 0.022 inch in diameter. After fitting one end of the spring into one of the two ligature channels of the twin-tie bracket, it is brought mesially or distally, whichever the treatment situation demands, to have its free end hooked around the arch wire and thereby fastened securely in position.

When the axial malrelations as well as the rotations of the anterior and posterior teeth are corrected, space closing is started. Provided that the Class I molar relationship which the patient had at the beginning of treatment still persists and provided that some slight forward movement of the posterior teeth may be tolerated in the space closing period of treatment, intramaxillary forces may be used in both dental arches. The auxiliary that is usually employed with the maxillary appliance to deliver intramaxillary force is the rubber elastic. These elastics, when chosen of proper size and stretched between hooks attached just posterior to the canines and the distal ends of the molar buccal tubes, deliver between 4 and 6 ounces of force.

When the elastics are used in this intramaxillary fashion, the maxillary lingual arch wire is removed.

On the mandibular appliance elastics may be similarly employed to close space; however, an 0.022 inch arch wire that has closing loops mesial to the canines is very effective in tipping the mandibular incisors lingually and is preferred. In order to get the maximum spring action from the chrome alloy wire when closing loops are used, it is necessary to heat treat it. This is accomplished by placing the fabricated appliance in an electric furnace equipped with a pyrometer and slowly raising the temperature to between 750° and 850° F. When a temperature in this range is reached, the heat is maintained for at least three, but preferably ten, minutes. The surface oxides that form on the appliance during its heat treatment may be removed quickly and easily by polishing with gold rouge on a rag wheel or the oxides may be removed in an anodic polisher. The rotating and uprighting springs used in this treat-

ment technique can be made more efficient auxiliaries if they too are heat treated in this way.

If the space between the anterior teeth must be closed without any forward movement of the posterior teeth, intramaxillary forces may not be used. Indeed, the use of any intraoral anchorage must be foregone. In its place extraoral anchorage, cervically derived, is used. If the anterior teeth in both dental arches must be tipped lingually with this anchorage, it is, of course, necessary to correct the mandibular teeth first.

To adapt the 0.022 inch chrome alloy wire (which at this stage of treatment is in place in the mandibular denture) to the use of cervical anchorage, hooks are soldered or welded to the arch wire at a point just mesial to the brackets of the right and left canine bands. These appliance hooks engage the commissural hooks at their proximal ends. The commissural hooks are formed from 0.045 inch chrome alloy wire and are attached, at their distal ends, to the metal fixtures at the ends of the cervical elastic strap.

After the mandibular anterior teeth are moved into contact with one another, the mandibular arch wire is tied back to the molars to maintain these relations while the extraoral force is shifted to the maxillary arch and space closing is started in this area.

Various combinations of intermaxillary and intramaxillary forces are applied during this space-closing period of treatment. The combination which is appropriate depends upon the occlusion of the posterior teeth. In some instances, as the space between the incisors is closed, the forward movement of posterior teeth in one or more of the quadrants of the mouth may be not only permissible, but desirable. Under such circumstances, the posterior teeth in the quadrant or quadrants involved could be subjected to a forward pull by an intramaxillary, as well as an intermaxillary, force. In any situation where the forward movement of the posterior teeth should not occur, there is an indication for the use of extraoral anchorage with little, if any, intraoral anchorage supplementing the treatment.

If proper selection and control of the forces used to close the spaces has been exercised, the Class I posterior occlusion that the patient had at the beginning of treatment should still be present when all the anterior spaces are closed.

RETENTION

With the spaces closed and the posterior occlusion satisfactory, the case is ready for retention. Following the removal of all the bands, impressions are taken for construction of retainers or a Kesling positioner.

The positioner has special merit in closing band spaces and making minor adjustments in the positions of the teeth prior to the placement of retaining appliances.

The retainers that we use are the Hawley type in the maxillary arch and the banded type in the mandibular arch. A flat plane may be added in the anterior portion of the upper Hawley if the vertical overbite is deep. The

mandibular premolars or canines may be banded and connected with a wire closely adapted to the lingual surfaces of the mandibular anterior teeth for retention of the lower dental arch.

SUMMARY

A treatment technique for the orthodontic management of extraction cases, using a modified Johnson twin arch wire, has been described. The areas in which this technique differs from the conventional twin arch wire technique are (1) the use of sectional appliances in the distal movement of canines, (2) the use of palatal anchorage accompanying the sectional arch wires, (3) the use of twin-tie attachments and round wires in the mandibular dental arch, and (4) the utilization of extraoral anchorage to augment the intraoral anchorage.

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CHANGES IN RELATIONSHIP OF POINTS A AND B DURING ORTHODONTIC TREATMENT

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One of the challenging problems in orthodontics is that of securing good facial balance and denture stability. This problem becomes increasingly difficult where a poor orientation of maxillary and mandibular apical bases exists. The question immediately arises as to what effect orthodontic treatment can have in bringing about better relationships of these skeletal landmarks, commonly referred to as point A and point B. From the standpoint of the clinical orthodontist, the problem soon narrows down to a consideration of whether or not one must accept the unfavorable jaw relationships present in the malocclusion. If so, the discrepancies must then be compensated for by tipping upper and lower incisor teeth toward each other. If not, it is possible, through orthodontic intervention, to achieve a better oriented jaw relationship and a more favorable relationship of teeth to their respective supporting bone and to each other.

This thesis is submitted as an interpretation of the over-all problem of apical base orientation and will present a practical application of the material in everyday clinical treatment.

Before considering the significance of unfavorable apical base orientation, it is necessary for one to have a clear mental picture of what is desirable in this aspect of the facial skeleton. A suitable method of evaluation immediately becomes a necessity in such a consideration. It is not the purpose of this article to disparage other methods of evaluation, but to present a simple, direct, and practical solution to the problems of a given case. Support for this concept is based primarily on cephalometric evaluation and clinical appraisal of cases treated by me and more than seventy-five cases treated by other orthodontists. It is only fitting that an expression of appreciation be extended to Dr. Charles H. Tweed, who has made his cephalometric records of both treated cases and his normal face sample group of individuals available for this study.

The angles SNA and SNB especially the difference between them, as described by Riedel[1, 2] and later adopted by Steiner,[3] the Northwestern University group,[4] and others as part of their analysis, have been used. The Steiner cephalometric analysis has been the primary basis for treatment evaluation on which these observations and conclusions have been reached (Fig. 1).

This thesis, which was given as a partial fulfillment of the requirements for certification by the American Board of Orthodontics, is being published with the consent and the recommendation of the Board, but it should be understood that it does not necessarily represent or express the opinion of the Board.

The planes NA and NB are excellent for such an evaluation, as they are readily located in a lateral head film in the very area that is to be influenced, namely, the skeletal profile. Both planes also offer means of readily measuring their respective incisors, as to both inclinations and positions relative to those planes.

The concept of normal, so visualized, is one in which the angle formed by the planes NA and NB, or the ANB angle, is very small. A difference of 2 degrees has been pretty well accepted as the ideal, although beautifully harmonized faces are found within a 3-degree range either way, or from a –1- to a 5-degree ANB angle. The greatest percentage of such faces, however, is found in the 0- to 2-degree range. The study of compensations in tooth position in persons having varying orientations of apical bases, but classified as nonorthodontic normal faces, is a most interesting field for research and application to one's clinical practice.

For some time, Tweed has been accumulating lateral head films of individuals whom he calls his "normal face sample group." These are persons with whom he comes in contact, appraised by him as having excellent facial harmony. I traced thirty-seven of these head films in order to evaluate them on the basis of the ANB angle and in order to study the relationship of their teeth to these planes and to their supporting bases. The cases were divided into five groups, with those having ANB angles of from 1 to 3 degrees occupying the center position. A range of 2 degrees was used for each group. The average upper incisor inclination, measured to the NA plane as an angle, and the lower incisor position, measured in millimeters, anterior to the NB plane for each of the five groups was arrived at, and the tracings in Figs. 2, 3, 4, 5, and 6 represent the case nearest the average for each group.

The significance of these findings is that Nature does an excellent job of compensating the position of teeth to the existing relationship of maxilla and mandible in those persons who have good facial balance. Logically, then, if the maxilla is in mesioversion and the mandible in distoversion, the very compensations shown in Fig. 6 are necessary to effect a good occlusion or, in other words, the lower incisors must be tipped forward and the upper incisors must be at a steeper inclination than in the Class III type of face (shown in Fig. 2) where the lower incisors are more upright, with a high axial inclination of upper incisors measured to the NA plane. In such cases, to establish the best occlusion possible, the upper incisors must reach out and the lowers must incline slightly lingually to compensate for the discrepancy in apical bases.

The fact remains, however, that the greatest number of well-harmonized faces was found near the 2-degree ANB range or slightly less. One should not hesitate to attempt to reduce an ANB angle of 5.5 degrees down to 1 to 2 degrees where a malocclusion and a lack of pleasing esthetics about the mouth exist, even though persons with that much convexity can be found.

It would be hard to conceive of a case having greater convexity in apical bases than the 5.5 degrees shown in Fig. 6 still being classified among a "nor-

mal face sample group." The presence of an excellent chin point appears to be the reason this case could be so classified.

The average lower incisor position, as measured anteriorly to the NB plane in these thirty-seven persons, was 3.1 mm. Where the ANB angle is 2 degrees, 3 mm. orients the denture very well.

It is my contention that treatment planning should not be based entirely on the Angle classification as shown in plaster models, wherein the key to occlusion is the anteroposterior relationship of the first permanent molars. It is more logical to include in one's treatment planning the relationship of the apical bases shown by landmarks located on the hard tissue profile of the patient as shown on the lateral head film.[5] Due consideration must then be given to the positional and angular relationships of the incisor teeth to these same landmarks or to the planes that they establish.

One must accept some variation in facial convexity as determined by the ANB angle. At the same time, one should constantly strive to bring about changes toward the more acceptable mean figure of 1 to 2 degrees.

The conditions wherein both apical bases are placed far forward or far backward relative to the particular face,[6] represent extreme types which are acceptable so long as points A and B are not too far from good orientation to allow normal occlusion, without excessive tipping of incisor teeth and with pleasing facial esthetics (Fig. 7).

In cases having poor apical base orientation, the angles SNA and SNB are often helpful in determining upon which arch efforts should be concentrated to effect the best facial change. This is illustrated in Figs. 8 and 9.

Excellent harmony can be found in different persons in whom the SNA angle varied from 88 degrees down to 70 degrees, but in whom the ANB angle was located in the previously described favorable range. A few degrees' variation in similar type faces can be expected on the basis of high or low placement of points S and N.

In view of the foregoing material, it is my considered opinion that orthodontists would do well to concentrate their efforts during treatment on methods that would most effectively change the ANB angle toward the ideal orientation of 2 degrees. Treatment evaluation indicates that most cases can at least be influenced (if treated during a period of active growth) toward the range of the normal face samples selected by Tweed.

Fig. 1.—Tracing showing the ideal relationship of maxillary and mandibular apical bases and of upper and lower incisors to their respective bases and to each other.

Fig. 2.—This is the only case where the ANB angle represented more facial concavity than -1 degree. The upper incisor has a high inclination of 31 degrees, measured to the NA plane. The lower incisor is positioned 2.5 mm. anterior to the NB plane.

Fig. 3.—This case is representative of the eleven cases found in the -1- to +1-degree range. The average incisor inclination was 25 degrees, measured to the NA plane. The average position of the lower incisor to the NB plane was 2.5 mm. anterior to NB.

Fig. 4.—This case is representative of the eighteen cases having the ANB angles from 1 to 3 degrees. The average upper incisor inclination measured to the NA plane was 20.5 degrees. The average lower incisor position was 2.9 mm. anterior to the NB plane.

Fig. 5.—This is one of the six cases falling in the 3- to 5-degree range of the ANB angle. The average upper incisor inclination was 17.2 degrees measured to the NA plane. The average lower incisor position was 4.75 mm. anterior to the NB plane.

Fig. 6.—This is the only case of the group with an ANB angle above 5 degrees. Here the upper incisor inclination measured to the NA plane was 13 degrees, and the lower incisor was positioned 5.5 mm. anterior to the NB plane.

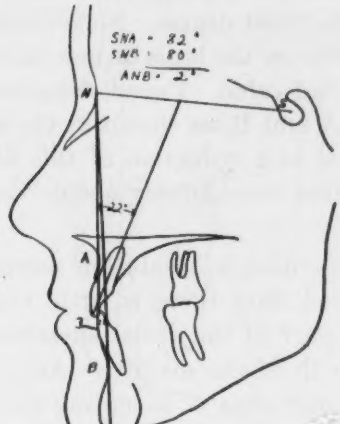


Fig. 1.

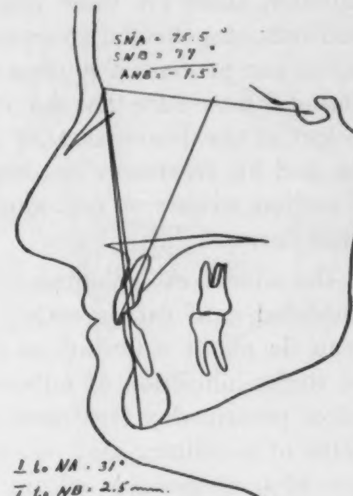


Fig. 2.

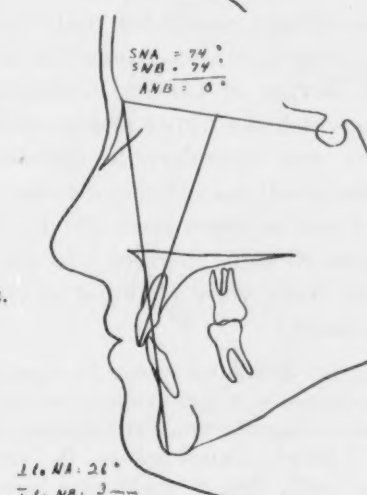
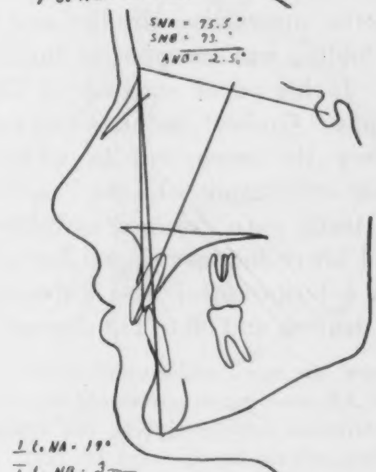


Fig. 3.



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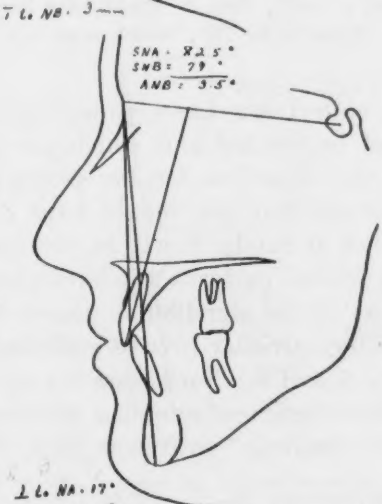


Fig. 5.

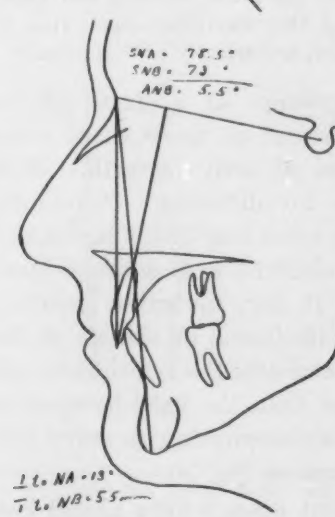


Fig. 6.

Figs. 1 to 6.—(*For legends, see opposite page.*)

Admittedly, there are those who discredit the idea that orthodontic intervention can influence skeletal structures to the least degree. Sometimes there is a tendency in our profession to discard an idea on the basis of new information, only to find at a later date that the original had value. Tweed, for example, has always looked at the discrepancy of points A and B, as shown in the mouth or on models, and his treatment has been aimed at a reduction of this difference. Even the earliest writers on orthodontics talked considerably about "developing the mandible forward."

With the advent of cephalometrics in the field, a conclusion seems to have been formulated, and rather widely accepted, that there is little that orthodontists can do about malrelations of any part of the facial skeleton, except perhaps a slight inhibition of anterior growth of the maxilla. As a result, a great deal of present-day treatment philosophy aims at accepting the existing relationships of maxillary and mandibular apical bases and securing the best compromise of teeth possible within that limitation. In 1940, on the basis of cephalometric appraisals, Brodie[7] and his co-workers concluded that "the most startling finding was an apparent inability to alter anything beyond the alveolar process." In his paper entitled "A Critical Review of Clinical Cephalometric Radiography," Graber[4] discusses two cases in which the upper and lower incisor angles were the same, but in which there was considerable difference in apical base orientation. In the case with the small maxillomandibular difference, the teeth were changed as follows: upper incisors from 107 to 100 degrees, and lower incisors tipped forward from 90 to 94 degrees. In the other case with a large apical base difference, the teeth were changed as follows: 107 to 89 degrees and 90 to 110 degrees. He states:

> To have the same ultimate objectives for incisal inclination would be most unwise. In the low AB case, tooth movement of the same degree still left a large overjet, which could be corrected only by tipping the upper incisors lingually to an all-too-erect 89°, the lower incisors all-too-far labially to 110°. Did it hold? Unfortunately, the answer is obvious. If the lower incisors had been stopped at 100°, then it would have been necessary to tip the maxillary teeth still further lingually to 79°, which was not feasible mechanically, esthetically or functionally.

Such a concept of a static relation of underlying bases is undoubtedly a good appraisal of those cases which must be treated and which are beyond any period of active growth. However, the objectives for the growing child should be far different. It follows, therefore, that one should have different objectives according to the particular problem at hand. It will be admitted that there are children with severe deviations in skeletal patterns who have a potential for little, if any, favorable growth response of the mandibular growth centers and little likelihood of change in the maxillary alveolar process sufficient to influence materially the relationship of points A and B. Such cases are the exception rather than the rule, however, and the experienced clinician will recognize them before attempting to carry out a "too idealistic" treatment plan. Such a case is shown in Fig. 10.

In most cases where apical base dysplasias of the Class II variety exist, the objectives should be: (1) to place the lower incisors in the best possible

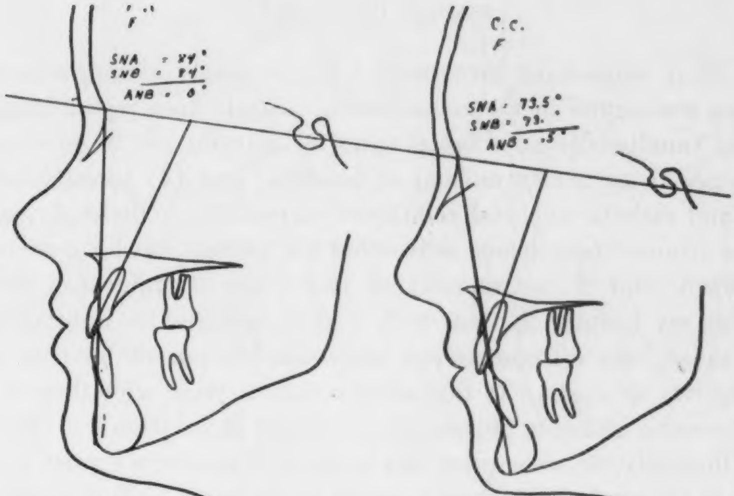


Fig. 7.

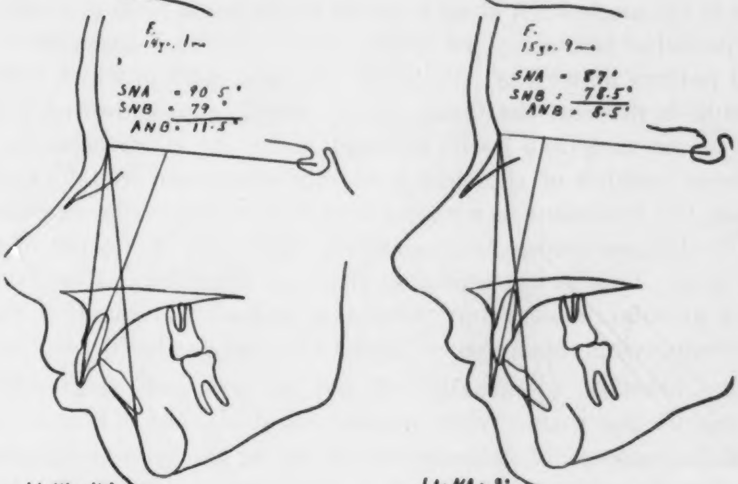


Fig. 8.

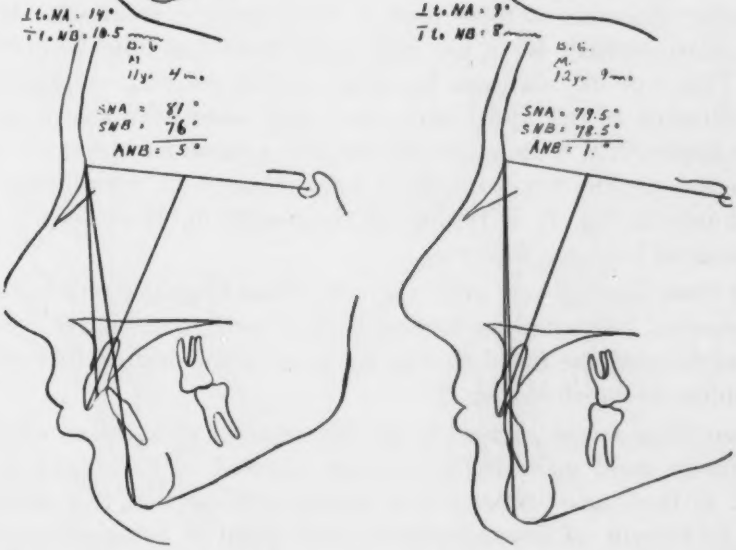


Fig. 9.

Fig. 7.—Two cases in which there is considerable variance in the prominence of the denture area of the face. Note that each still has well-oriented apical bases and a general appearance that is pleasing.

Fig. 8.—This case could best be helped by a reduction in SNA. The completion tracing at the right shows the SNA angle 3.5 degrees smaller than the original malocclusion tracing.

Fig. 9.—This case needed an increase in SNB. The 2.5-degree increase shown here is the largest increase of the SNB angle the author has found to date.

relation to their supporting structures (this is nearly always a more lingual position than that found in the malocclusion); (2) to keep upper incisors with a pleasing and functionally good labial axial inclination; (3) to reduce the apical base difference to as nearly normal as possible; and (4) to establish the best functional and esthetic occlusal relationships possible. Obviously, such objectives can be attained only if one is treating the patient during a period of good skeletal growth, and if the underlying bases can be influenced through our efforts. It is my contention that, with proper orthodontic intervention at the right time, apical base differences can be reduced to normal, or near normal, in a great majority of cases. If this observation is true, why then is it unwise "to have the same ultimate objectives for incisal inclination" in the two types of cases? Obviously, to accomplish this broader objective, we must secure either a reduction in the angle SNA or an increase in the angle SNB of sufficient extent during the period of treatment and during posttreatment supervision to influence the original pattern materially. In nearly all these cases in which a large apical base difference is present, the facial change which is most desired is a forward positioning of the mandible itself, although there are a few cases in which the anteroposterior position of the chin is exactly where one would like to keep it and in which the treatment objective would thus change from emphasis on forward mandibular positioning to a relatively backward placement of the maxillary structures. This is accomplished through inhibition of anterior growth of maxillary alveolar process and through a lingual movement of the alveolar process accompanying retraction of upper anterior teeth.

In actual practice, we usually will get some of each if growth is active and if we are dealing with a fairly normal mandible, but it is most interesting to note that the response of patients treated by me has been pretty much in line with the major direction of force used in making the corrections. Where only very light intermaxillary force has been used, there has been little mandibular response. This type of treatment has been carried out with emphasis on extraoral force directed to the upper arch, and such cases have shown good reductions in the angle SNA, with maxillary teeth in a much more relative backward position to the profile but with little improvement of mandibular position. The case shown in Fig. 11 is typical of the results obtained by me when this type of treatment has been followed.

On the other hand, where very vigorous Class II elastic pull has characterized the treatment following the tipping back of teeth in the lower arch to establish better anchorage, the facial change has been of the desired forward mandibular positioning, as shown in Fig. 12.

For some time I was puzzled as to why some of these cases with evidence of exceptionally good mandibular response showed only a slight increase, or none at all, in the angle SNB. It has become evident that this was the result of lingual movement of lower incisors, with point B being changed a great deal in relation to the body of the mandible, plus bite opening in some cases. The exaggerated forward positioning of point Po, or the chin itself, results in a facial change which is most gratifying to observe in these cases with large

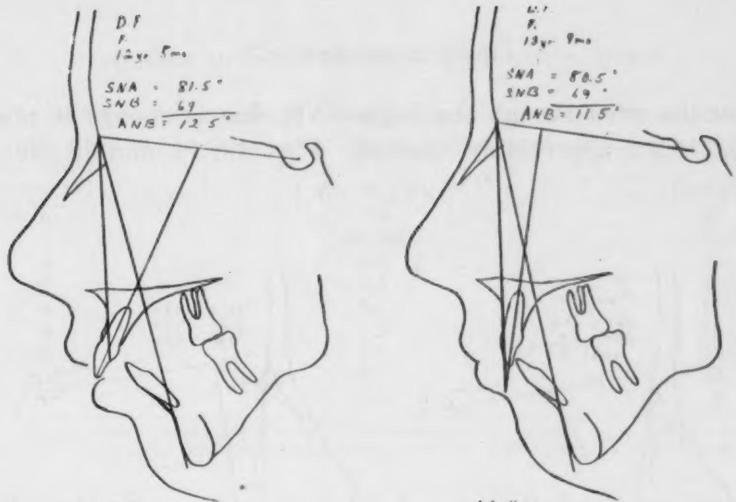


Fig. 10.

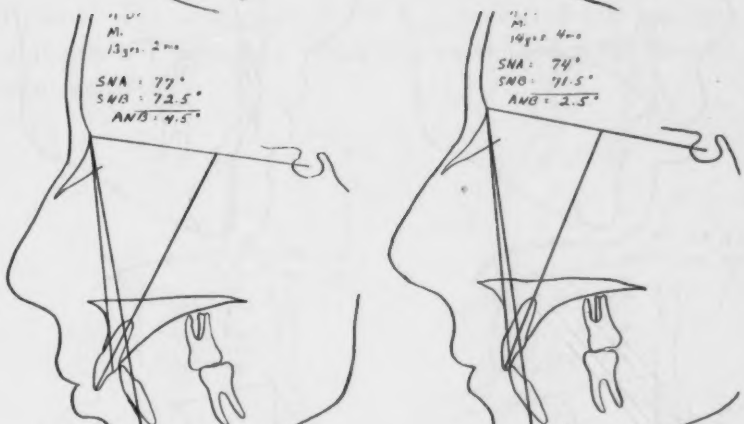


Fig. 11.

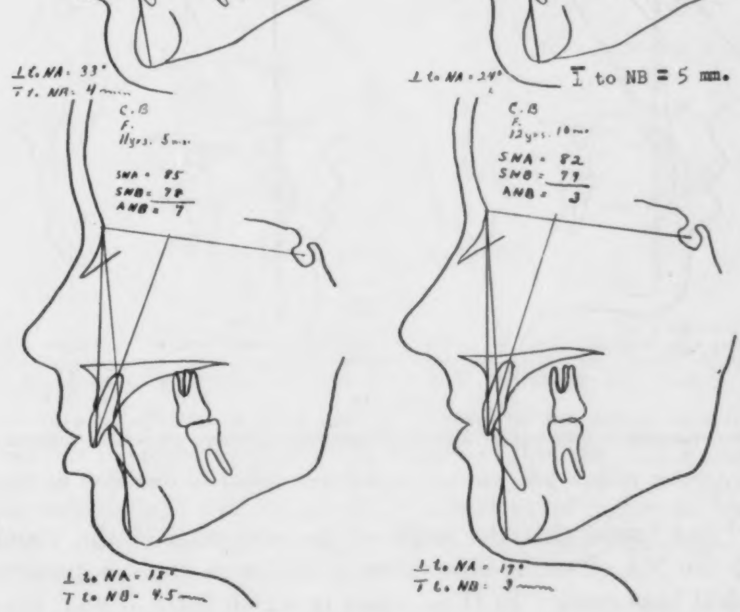


Fig. 12.

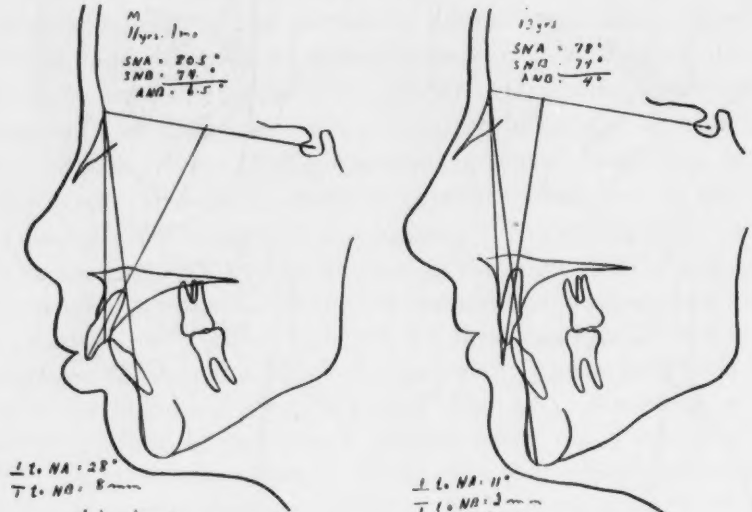
Fig. 10.—This case is representative of those having extreme deviations in skeletal pattern.

Fig. 11.—This case illustrates the usual result obtained by this writer when very light intermaxillary force is used without adequate tip-back anchorage preparation. Such treatment is carried out primarily through headgear force. Note that lower anchorage has slipped forward, even though the elastics worn produced only the lightest possible pull and were worn only during those hours that headgear could not be worn. This loss of anchorage is attributed to the lack of adequate tip-back anchorage preparation.

Fig. 12.—An excellent adjustment of apical base relationship toward the normal, with a corresponding improvement of facial contour.

AB discrepancies even though the angle SNB, due to change in point B and bite opening, is not appreciably effected. Figs. 13, 14, and 15 illustrate this point.

Fig. 13.



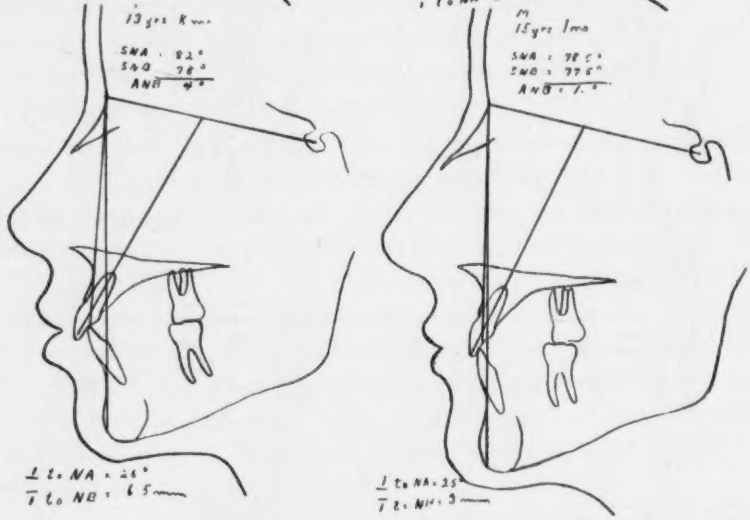


Fig. 14.

Fig. 13.—A patient exhibiting a marked mandibular growth response, although the SNB angle is unchanged.

Fig. 14.—Another patient who has had a response similar to that seen in Fig. 13.

Steiner[3] has found that the angle of the long axis of the upper incisor, measured to the NA plane, is ideal when a 22-degree angle is present in well-oriented apical base cases. In those cases in which little, if any, growth is to be expected, but in which there are varying amounts of discrepancy in the relationship of the apical bases, I seldom have been able to maintain such a favorable axial inclination of the upper incisors. Neither has it been possible, in such cases, to keep the lower incisors at the desired position, 3 mm. anterior

TABLE I. POSITION OF LOWER AND UPPER INCISORS ACCORDING TO THE ANB ANGLE

ANB ANGLE (DEGREES)	$\overline{1}$ TO NB (MM.)	$\underline{1}$ TO NA ANGLE (DEGREES)
up to 4	3.0	22
5	3.5	21
6	4.0	20
7	4.5	18
8	5.0	17
9	5.5	15
10	6.0	13
11	7.0	11
12	8.0	8

Note: Those cases requiring Class II intermaxillary elastic pull should have the lower incisors positioned lingually an additional 2 mm. before the Class II correction is made.

to the NB plane. For such cases, Table I is submitted as a guide to tooth position, using planes for reference which are associated with skeletal landmarks on the patient's profile.

Fig. 15.

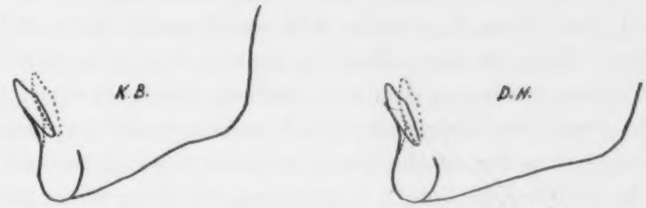


Fig. 16.

Fig. 15.—Tracings of the lower incisors of Figs. 13 and 14 with the tracings of the mandible superimposed on the symphysis and lower border. The dotted outlines show the position of the lower incisors at the end of active treatment and clearly illustrate the change in point B.

Fig. 16.—Typical changes in tooth position observed by the author in a limited number of cases following active treatment. The dotted outline shows the position of the teeth after they have had time to upright themselves from tipped-back positions.

The question might well be asked: "Which cases cannot be treated to the favorable 0- to 4-degree ANB range?" The following observations are used as a guide in this respect:

1. Nearly all girls 13 years of age or over and boys past 16 years of age.

2. Children younger than this who obviously have had a growth and maturation rate earlier than normal.

3. ANB angles greater than 9 degrees, regardless of type of mandible.

4. SN—GoGn plane angles in excess of 40 degrees, where associated with ANB angles greater than 5 degrees.

Since the most important adjustments in apical base relationships are dependent upon growth, it behooves one to select a time for treatment when there will be adequate remaining growth so that an appreciable adjustment of apical bases can still be achieved. It is illogical to postpone treatment until the permanent second molars have erupted. In many cases, such postponement places the patient at the end of effective facial growth.

The greatest angular change in this reorientation of bases is that occurring in the SNA angle where there is a combination of inhibited maxillary alveolar growth and actual change in point A following retraction of upper incisors. The change producing the greatest improvement in facial balance, however, is that occasioned by mandibular growth in excess of that expected according to the growth of the rest of the face. Therefore, in accomplishing these changes, it seems logical that Class II elastics will continue to be used by a majority of the profession. This, in turn, dictates that vigilance be practiced at all times to be certain that the lower denture, and especially the incisors, is not moved forward into positions interfering with muscle function, assuring future collapse. Undue depression of the lower incisors is a common complication which also should be avoided, although it is difficult to do so when using strong elastic pull. This is due to the downward pull on the upper incisors, resulting in an elongation of these teeth. At least, there is a lack of equal depression of upper incisors to that taking place in the lower, inviting return of the excessive overbites. There is always an accompanying tipping of the occlusal plane unless special precautions are taken. The use of supplemental, extraoral anchorage in the form of high headgear pull to offset the downward pull of the elastics, plus exaggeration of the curve of Spee in constructing upper arch wires, will aid greatly in preventing this abuse of lower incisors. These are the weakest teeth in the mouth and the ones least prepared for excessive depressing movement.

There are always certain cases about which one is in doubt as to what can be expected in the reorientation of the apical bases during treatment. There are age and sex implications and unfavorable skeletal patterns. There are also those who apparently are in a quiescent state as far as skeletal growth is concerned where growth would normally be expected at that time, all of which makes the application of any exact rule or standard most difficult in orthodontics. I have found a workable solution for questionable cases to be the positioning of the lower incisors at the point shown in Table I, plus an additional 2 mm. further lingual positioning. If we fail to get the desired growth and reorientation of bases during treatment, this allows for the inevitable anchorage slippage without allowing the lower incisors to become more protrusive, due to intermaxillary elastic pull, than found in the malocclusion.

It must be recognized that all types of treatment, such as those using guide planes, those using very mild intermaxillary forces without full arch banding,

and those utilizing cervical gear, can show some cases exhibiting these favorable growth responses. However, one cannot study tracings of patients consecutively treated by Tweed without being profoundly impressed with the frequency and extent of such changes invited by his treatment procedures. Where such changes do take place and the ANB angle is reduced, let us say in a typical case from 7 to 3 degrees, this will usually occur before the lower incisors have tipped forward beyond the desired position, 3 mm. anterior to the NB plane. If no growth response is forthcoming, continued Class II treatment will result in the lower incisors positioning themselves at or very near the 4.5 mm. shown in Table I.

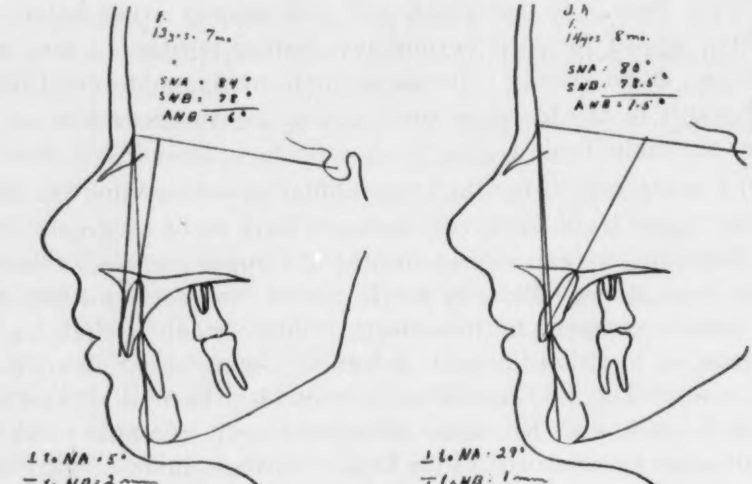
When a great deal of forward mandibular growth occurs, the distal movement of the upper teeth obviously does not have to be as great. In growing patients, therefore, we can expect to hold the upper incisors at more pleasing labial-axial inclinations. This, in itself, creates "toe hold" anchorage resisting excessive distal movement of these teeth. Very often, in studying our headplate tracings, we find that the teeth in both arches are very well oriented to their respective bases, but still a Class II malocclusion is present, due to a Class II relationship of apical bases. En masse distal movement of upper teeth loses some of its significance when viewed in the light of changes in apical base orientation. Then, we can also treat with considerable less tip-back of the upper teeth, which is a good thing because it now appears, on the basis of preliminary investigation, that tipped-back maxillary teeth shift considerably further forward as they upright themselves during and after retention than do teeth in the mandibular arch tipped back to the same degree. This, if true, explains why there is a tendency for cases treated to coordinate tipped-back positions of buccal segment teeth in both arches to lose some of the correction of molar relationship when appliances are removed; it also explains the necessity for so much overcorrection in this respect. Where the case is retained with considerably more tip-back of the teeth in the lower arch than of those in the upper, this tendency is greatly minimized. In the lower arch, the center of rotation, as the teeth come out of the tipped-back positions, seems to be at about the junction of the crown and root portions of the teeth, resulting in only slight mesial shift of the crowns of the teeth with the molar roots settling back somewhat toward their original positions, while in the upper buccal segment the center of rotation is usually near the root apices. This is illustrated in Fig. 16.

Nearly all arch length discrepancy cases that require extraction of four premolar teeth can be corrected successfully if the upper first molar is not moved distally. Our objective in treating these cases should be to proceed in such a manner that no mesial migration is allowed. When this does occur, we are prone to use excessive second order tip-back bends in the arch wires to secure correct cusp-fossae relationships during the later stages of treatment.

In attempting to treat for apical base reorientation, as already has been pointed out, keeping a good labial axial inclination of the upper incisors should be one of our objectives. This is helpful because bodily retraction of these teeth effects a more marked reduction in the angle SNA than do mere lingual tipping

movements of these teeth. It is doubtful that the cases shown in Figs. 17 and 18 would have exhibited as much change in apical base orientation or in facial contour if this principle had not been followed.

Fig. 17.



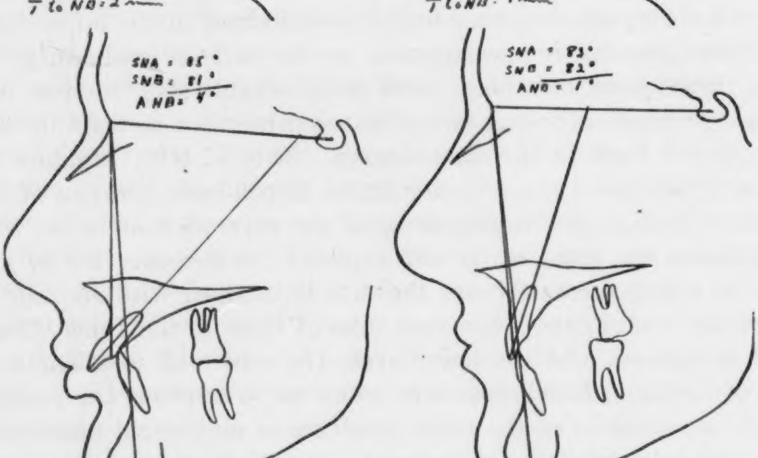


Fig. 18.

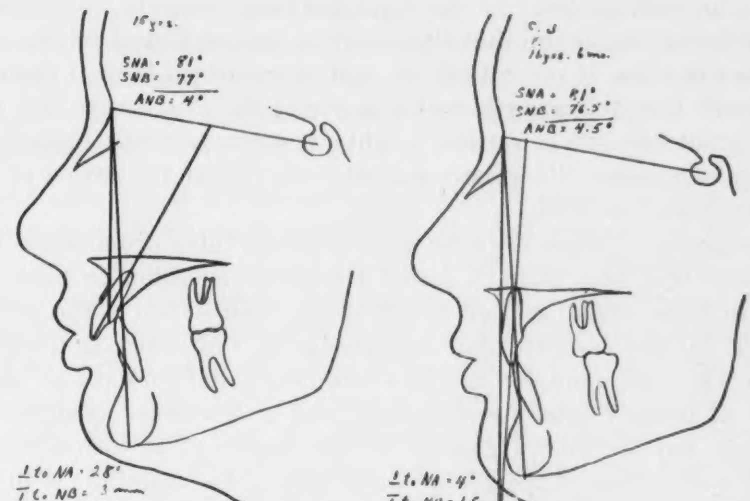
Fig. 17.—This case demonstrates a marked improvement of upper incisor axial inclination which was a factor in the favorable reorientation of apical bases.

Fig. 18.—In this case the upper incisors, which had presented an extremely high labial axial inclination, were tipped back to an ideal 22 degrees and moved bodily from this point.

All too often, lingually tipped upper incisors will have the root apices in a more forward position than that found in the malocclusion and, as they approach the labial cortical plate, the tendency for resorption is greatly aggravated. Under such circumstances, point A is not improved and, therefore, the improvement of facial esthetics is limited. Such a case is shown in Fig. 19.

Certain cases, such as the one shown in Fig. 20, need treatment on the basis of occlusion and facial esthetics, even though the original ANB angle was not excessive. It is evident from the facial improvement that an ANB angle of -1

Fig. 19.



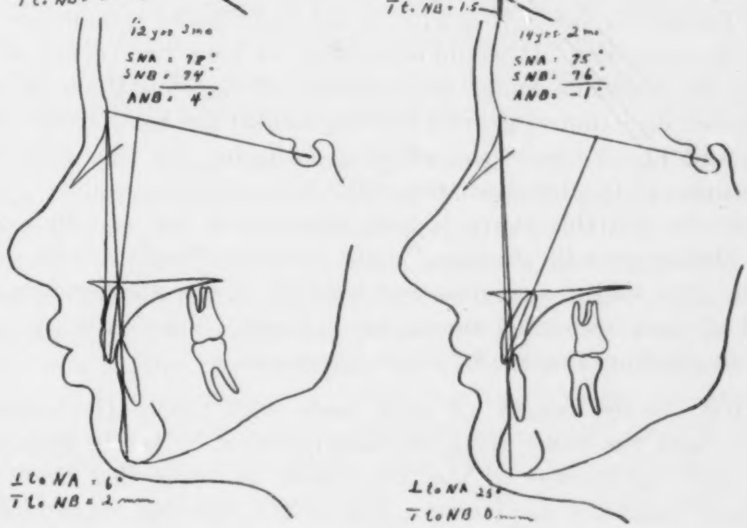


Fig. 20.

Fig. 19.—In this case the upper incisors have been tipped to an axial inclination that is much too steep. This does not encourage favorable apical base changes.

Fig. 20.—A Class II, Division 2 type of case in which the ANB angle was only 4 degrees in the malocclusion. An angle of -1 degree at the end of treatment has contributed to the pleasing facial change.

degree is better for this girl. The very straight faces having ANB angles at the end of treatment from 0 to 2 degrees are more favorable for stability than those in the 3- to 4-degree range.

This philosophy of treatment endeavors to bring about more forward positioning of mandibles than would otherwise occur. It is also necessary to

theorize regarding what characterizes the change when we get a favorable mandibular growth response. It can be reasoned that the growth takes place with the head of the condyle held somewhat forward and riding down on the eminentia articularis as a result of intermaxillary elastic pull. The direction of growth is altered while this elastic force is exerted, and there is an attempt by Nature to seat the head of the condyles back securely in the mandibular fossae. Ricketts[8] has found that the condyles are positioned further backward in the fossae in Class II patients at the end of treatment than at the beginning. We also know that this growth center is one of the most active and that it accounts for great amounts of vertical height. It seems perfectly logical, therefore, that the use of intermaxillary force can alter the rate and direction of deposition of new bone in such an area.

The majority of cases showing greater mandibular prominence at the end of treatment will also show a lower Frankfort-mandibular plane angle or SN-to-GoGn plane angle, as used in this study, than shown in the malocclusion. This would further indicate that appositions in the condylar growth center, laid down while the condyles are held downward and forward on the eminentia, result in greater total ramus height and a downward positioning of the gonial angle but without a change in this angle. The over-all result of a downward positioning of the gonial angle area of the mandible is to swing the chin point Po further forward to give us the mandibular prominence we desire to achieve in treatment. It would seem that we have two factors at work repositioning the mandible under the influence of vigorous Class II treatment: (1) the altered direction of growth tending to seat the head of the condyles in the fossae and (2) the beneficial effect in swinging the chin forward by the lowered position of the distal portion of the body of the mandible.

I choose to call this characteristic behavior of the mandible a "Tweed type mandibular growth response"—not because Tweed is the only orthodontist who gets such a response, but because of the greater frequency and the extent of such responses among his patients. The following factors are offered in an attempt to account for this phenomenon:

> First, Tweed begins all such cases with Class III elastic pull tipping back the lower teeth to establish what he terms dynamic or "toe hold" anchorage of the lower arch in order that these teeth will later resist the displacing action of the vigorous Class II elastic pull. The immediate effect is to tip the occlusal plane downward at the distal side due to the downward and forward pull of the Class III elastics. These lower-positioned upper molars tend to become the fulcrum point around which the mandible rocks when it is later held forward by Class II elastics.
>
> Second, lower molar teeth that are well tipped back resist the usual tendency to elongate, a tendency so noticeable when Class II elastics are applied to a lower arch without first tipping them back. This may be explained on the basis of the increased amount of alveolar bone overlying the roots of the posterior teeth. This bone effec-

tively resists the upward component of pull from the Class II elastics. Therefore, we have a situation in which the upper posterior teeth are encouraged downward early in treatment before they are appreciably tipped back and lower anchor units, if properly prepared, are encouraged to resist this elongating effect.

Third, Tweed's treatment is vigorous. Approximately one-third of his total treatment time is devoted to the preparation of lower anchorage, and still his over-all treatment time averages about fifteen months for extraction cases and thirteen months for non-extraction cases.

It would appear that the use of Class II elastics must overcome the normal muscle tonus or pull which is responsible for rest position of the mandible before an alteration of direction of growth is achieved. The teeth comprising the lower anchorage must resist this displacing force long enough that sufficient alteration in orientation of maxilla and mandible is achieved to effect materially the correction of the Class II condition. It must be admitted that there will always be some tooth movement going on within alveolar processes. It would seem, therefore, that the alteration in the orientation of the apical bases through mandibular growth response and inhibition of growth centers related to the forward growth of the maxillae are the most important factors in creating facial harmony and stable orthodontic results.

Two other things are also taking place during the period in which the response to orthodontic treatment is most rewarding:

First, it has been pointed out by Downs,[9] Lande,[5] and others that the face is naturally more convex in the mixed dentition than at a later date. We are, working, therefore, with something that Nature is trying to accomplish anyway and, when we do so, our chances of success are much greater than if we were trying to get straight faces (assuming that the genetic tendency were for straight mixed dentition faces to become convex during the transition to permanent dentition and during adolescence). The fact that certain mechanically locked dentures respond with a similar mandibular growth following the mere insertion of a bite plate further indicates that better orientation of denture bases is in line with natural growth and development.

Second, through studies, Ricketts and others have pointed out a decided tendency for faster downward growth of the teeth in the upper molar areas than in the upper incisor area during the usual age period in which orthodontic patients are treated. It is logical, therefore, to follow any and all procedures which tend to resist the usual type of tipping of the cant of the occlusal plane to a higher degree due to elongation of lower molars during orthodontic treatment. Severe depression of lower incisors and elongation of upper anterior teeth are the other untoward effects. Careful adherence to

the procedure of setting up lower tip-back anchorage, plus the use of headgear force attached to the anterior of the upper arch wire and directed from a very high angle, is our best insurance against these undesirable side effects of treatment. There is undoubtedly a tendency for these tipped occlusal planes to return toward the original during and after retention, but this is accomplished by the more rapid downward growth of upper depressed posterior teeth and the tendency of the depressed lower incisors to elongate to their correct height. The most desirable thing during this adjustment period would be the depression of upper incisor teeth to a point equaling that required of the lower incisors, but this just does not happen in the cases that I have studied. Thus, we have the inevitable return of the deep overbite as the lower incisors come back up to position, with the unesthetic appearance of the incisal edges of the maxillary incisors being too low in relation to the lip line.

Of the last fifty cases with ANB angles in excess of 4 degrees, the average reduction in the ANB angle has been 2.33 degrees. Certain cases have shown reductions as high as 5 degrees. This would be much higher if it were not for the effect on point B of lingual tipping of lower incisors and of bite opening. It is almost impossible, therefore, to express statistically the net facial improvement of reductions in the angle ANB.

SUMMARY

1. The angles SNA and SNB, and especially the difference between them, are a good basis on which to evaluate and plan treatment.

2. Normal face samples show variation in apical base orientation with compensating variations in the positions of the teeth.

3. Treatment objectives should aim at reducing high ANB angles to as near 0 to 2 degrees as possible.

4. Good facial harmony is found in both prognathic and orthognathic persons so long as the apical base orientation does not exceed a range permitting compensating dental adjustments.

5. Patients treated during periods of active growth respond with better apical base changes than do patients treated during nongrowth periods.

6. The nature of the change in relationships of points A and B is influenced materially by the type of treatment followed.

7. The ideal position of the lower incisor (3 mm. anterior to the NB plane) should not be maintained where the apical base dysplasia cannot be reduced to 4 degrees during treatment. Therefore, a flexible scale for incisor orientation is presented in Table I.

8. The greatest angular changes occur in the SNA angle.

9. The treatment response most desired in most Class II cases is one of forward mandibular positioning due to alteration in the amount and direction of growth, primarily in the growth site at the head of the condyles.

10. The use of Class II elastics of sufficient pull for a long enough period of time to bring about the desired mandibular growth response necessitates the tipping back of mandibular teeth to positions of dynamic anchorage in the first stages of treatment, as described by Tweed.

11. The forward development of the lower third of the face is in harmony with the most common growth changes occurring at this time.

12. Good reductions in the ANB angle have taken place in nearly all cases having higher than a 4-degree ANB angle in which active growth occurred.

CONCLUSION

Orthodontic treatment should seek to change the relationship of maxillary and mandibular apical bases to as near the ideal as possible. We will achieve more pleasing facial harmony and dental esthetics, plus greater denture stability, if we strive for this ideal rather than if we follow the procedure of tipping the incisor teeth to effect the easiest establishment of normal occlusion, a procedure which does not produce adequate facial change.

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MANDIBULAR ANCHORAGE AND EXTRAORAL FORCE

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INTRODUCTION

Since the introduction of intermaxillary elastics by Baker[1] in 1904, the effects produced by elastics in the treatment of Class II cases have received much consideration. Some of these effects, which at first seemed helpful, appeared less desirable as concepts of diagnosis changed, based on evidence that the maxillary first permanent molar does not always erupt in a correct relationship to the skull. It is now becoming generally accepted that a relatively small percentage of Class II malocclusions can be corrected by a mesial movement of the mandibular dental arch, a repositioning of the mandible, or a combination of both. Increasing efforts are being devoted to the problem of preserving the integrity of the mandibular dental arch while it is being used as resistance to move segments of the maxillary dental arch distally. This article is concerned with these efforts, with particular attention given to the use of extraoral force.

MANDIBULAR ANCHORAGE

Various views have been expressed concerning the adequacy of the mandibular dental arch as anchorage. These range from claims that anchorage is never a problem to statements limiting or condemning its use. Brodie, Downs, Goldstein and Myer,[2] and Fischer[3] have shown that the mandibular dental arch is always more or less affected in its role of anchorage by reciprocal intermaxillary forces.

The adverse effects of intermaxillary elastics may be indicated by one or more changes in the mandibular dental arch during treatment. The first molars may be rotated or tipped mesially. The premolars may tip mesially and become locked under the distal bulge of the teeth mesial to them. They also may be displaced buccally or lingually. The mandibular cuspids may tip mesially and slip contact with the lateral incisors, and they may also rotate. The curvature of the occlusal plane of the mandibular dental arch may increase. The mandibular anterior teeth may become overlapped or crowded out, or their labial axial inclination may increase. Finally, the entire mandibular dental arch may be displaced anteriorly. These changes are symptoms of a failure to preserve anchorage. However, if the number and severity of the above changes are held

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to a minimum while treatment objectives are attained, we may assume that, for all practical purposes, the maintenance of anchorage has been successful.

Many factors influence the stability of mandibular anchorage. Each individual tooth depends on bone support to resist displacement. Weinmann and Sicher[4] state: "Pressure exerted upon the tooth is, via principal fibers of the periodontal membrane, transmitted as tension to the bone." It follows that more bone becomes available to resist tooth displacement as a greater root surface area is used or as a greater number of teeth are used in anchorage. The selection of a minimum number of teeth for movement in the maxillary arch decreases the amount of resisting bone to be overcome and reduces the displacing forces acting on mandibular anchorage. In some Class II cases, in order to spare mandibular anchorage, the extraction of certain maxillary permanent teeth may be a necessary compromise. In other Class II malocclusions, in which the mandibular buccal segments are mesially displaced to such an extent as to make mandibular anchorage unusable, the extraction of two mandibular and two maxillary premolars must be considered in planning treatment. This controversial problem is encountered more frequently in Class I than in Class II cases.

A number of other factors affect the stability of mandibular anchorage. The elimination of occlusal interference during the process of moving teeth reduces the strain on anchorage. The proper contact of adjacent teeth to form an unbroken mandibular dental arch increases the resistance to displacement. Tweed[5] uses "prepared" mandibular anchorage, in which the axial positions of the teeth are so arranged as to resist mechanically the force that eventually will be used in treatment. The health of the supporting structures of the teeth and the action of the adjacent musculature on the teeth influence anchorage. The magnitude, duration, and direction of reciprocal forces produced by elastics have an effect on mandibular anchorage. These may be reduced appreciably by the use of extraoral force. Extraoral force has been employed in orthodontics for many years. Case[6] and Oppenheim[7] made extensive use of it in treating Class II malocclusions.

The actual choice of a particular orthodontic appliance is secondary to an understanding of the principles involved in maintaining anchorage. It is by applying these principles during treatment that we are able to make effective use of the appliances for which we happen to have a personal preference. In the mandibular dental arch (Fig. 1), a lingual arch is used which fits low on the cingula of the anterior teeth and extends distally to include the second molars. The lingual arch is made of 0.038 inch gold wire. The labial arch is 0.010 by 0.020 inch steel wire drawn into end tubes, a type used in Johnson's[8] twin arch technique. It is locked in the buccal tubes and to the first premolars and cuspids, and it is ligated to the incisors and lingual arch. This illustrates one method of including a maximum number of teeth in mandibular anchorage to increase stability. The edgewise appliance[9] and the stabilizing plate[10] are other efficient methods of utilizing the same principle.

THE USE OF EXTRAORAL FORCE

Johnson's twin arch appliance[11, 12] (Fig. 2, *A*) is effective in treating permanent dentition Class II cases, especially those characterized by a protrusion

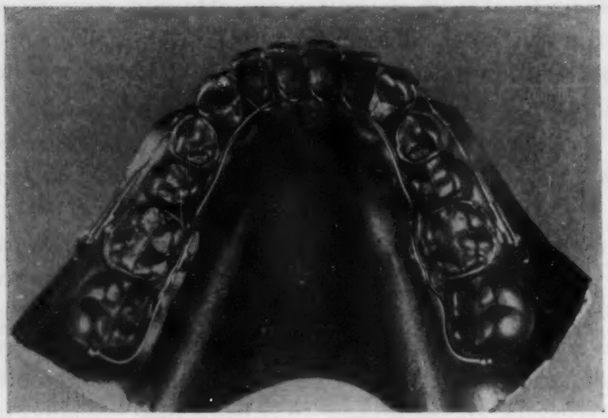
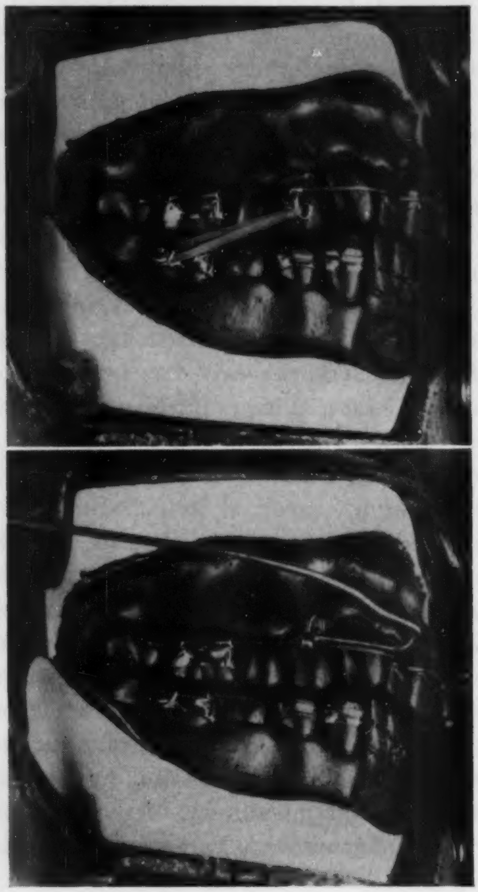


Fig. 1.—Technique model with lingual arch and labial arch used to establish mandibular anchorage.

A.

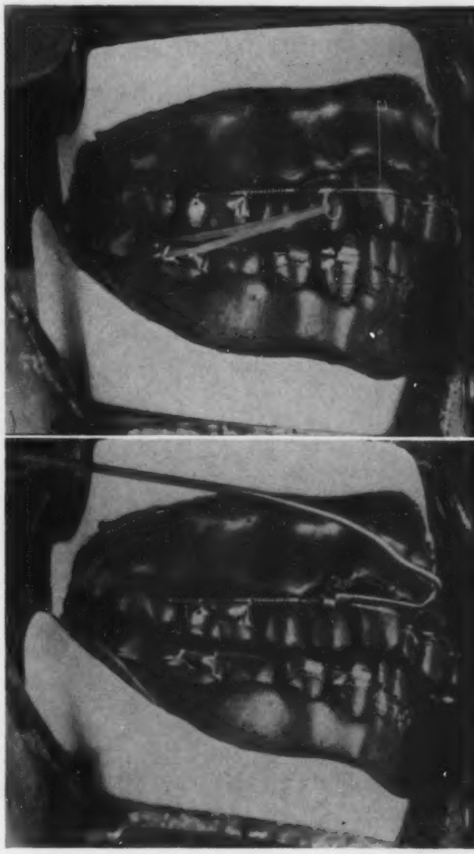


B.

Fig. 2.—*A*, Intermaxillary elastic force acting on maxillary incisors by way of the twin arch appliance. *B*, Extraoral force replacing intermaxillary elastic force, acting on maxillary incisors by way of the twin arch appliance. Technique models are shown.

of the maxillary dental arch. It adapts well to the principle of selecting a minimum number of teeth for movement in the maxillary arch, and its low frictional resistance adds little to the load on mandibular anchorage. In addition, it is easily modified for use with extraoral force (Fig. 2, *B*). According to Johnson's teachings, the maxillary incisors are retruded in the first stage of treatment by using the mandibular dental arch as anchorage and by wearing intermaxillary elastics day and night. It is possible, with a cooperative patient,

A.



B.

Fig. 3.—*A*, Intermaxillary elastic force neutralizing anterior force of coil spring. The distal force of the coil spring is acting on the maxillary first molar. *B*, Extraoral force, replacing intermaxillary elastics, neutralizing the anterior force of coil spring. The distal force of the coil spring is acting on the maxillary first molar.

to substitute extraoral force for intermaxillary elastics eight to twelve hours each night. The duration of reciprocal forces acting on mandibular anchorage is thereby reduced approximately 30 to 50 per cent. The force acting on the maxillary incisors should not exceed 2 ounces, whether it be intermaxillary or extraoral force. Johnson states that after the maxillary incisors have been brought into contact with the mandibular incisors, and an intruded position is noted in the maxillary cuspids or first premolars, coil springs are activated

against the maxillary first molars by pinching the end tubing mesial to the coil springs. In this stage of treatment the amount of intermaxillary elastic force is increased to prevent the maxillary incisors from being displaced labially by the reciprocal force of the coil springs which are moving the maxillary first molars distally (Fig. 3, *A*). The use of extraoral force now replaces the intermaxillary elastics at night, neutralizing the anterior force of the coil springs (Fig. 3, *B*). Thus, the magnitude and duration of displacing forces acting on mandibular anchorage are lessened.

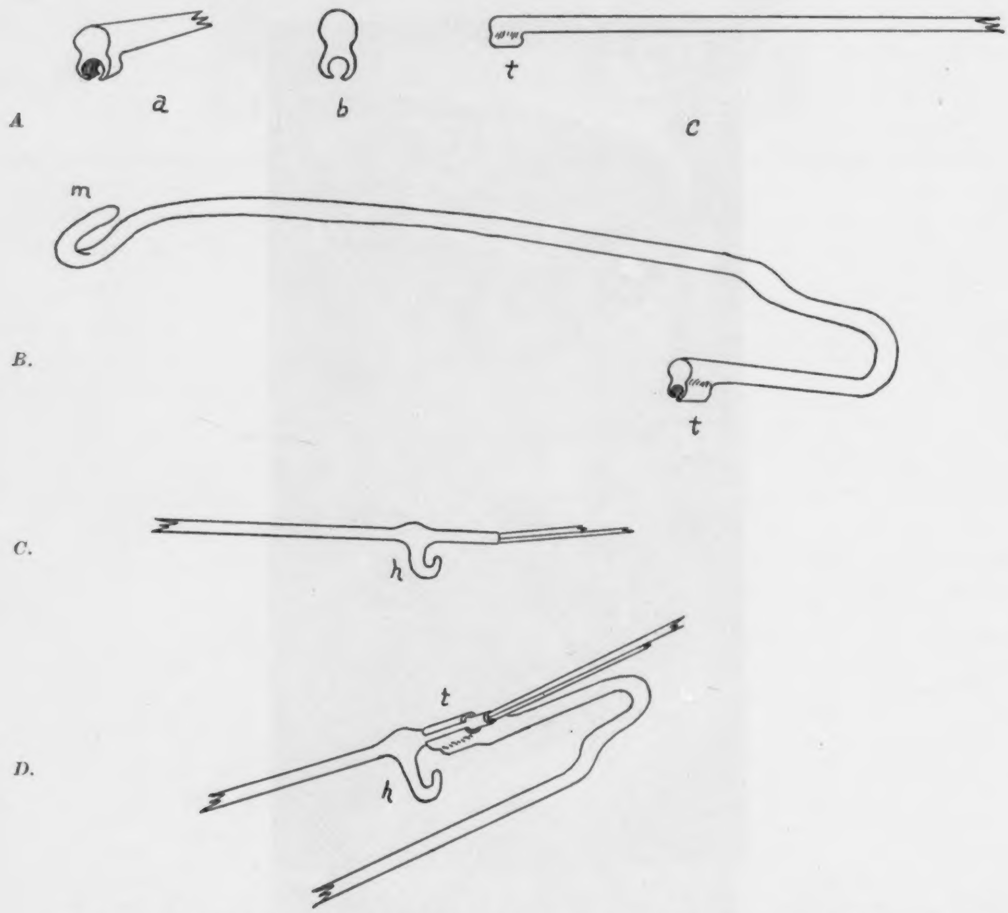
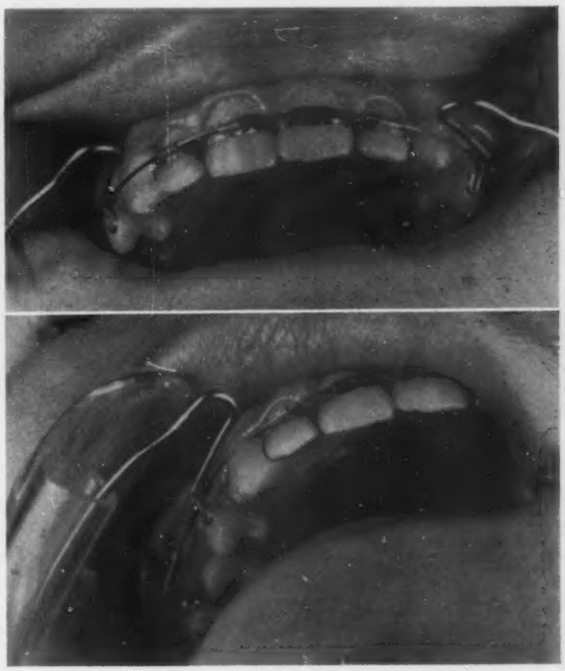


Fig. 4.—*A*, Slit tube soldered to end of 0.050 inch wire (*a*, perspective view; *b*, cross section; *c*, lateral view). *B*, 0.050 inch wire bent into shape with slit tube (*t*) and hook (*m*) for extraoral elastics. *C*, Intermaxillary elastic hook (*h*) set back on end tube of twin arch appliance to allow space for *t*. *D*, Slit tube (*t*) in place on end tube resting against hook (*h*).

Fig. 4 represents the steps in construction of the appliance which transmits the extraoral force to the teeth by way of the twin arch appliance. Fig. 4, *A* shows a drawing of a one-quarter-inch length of 0.036 inch (inner diameter) tube soldered to the end of an 0.050 inch wire. Both the tube and wire are of stainless alloy. The cross-section view depicts the longitudinal cut which is made in the tube of sufficient width to allow the passage through of a twin arch (two 0.010 inch wires) or an 0.010 by 0.020 inch flat wire arch. The 0.050 inch

wire is then bent in the form of a loop, as shown in Fig. 4, *B,* to curve around the corners of the lips. About three inches back on the wire, a hook is made to receive the extraoral elastic. Fig. 4, *C* shows the twin arch with intermaxillary hook set back about one-quarter inch from the mesial end of the end tubing. This is to allow space for the slit tube of the extraoral appliance to slip on. The intermaxillary hooks may be soldered directly on the end tubing or on a tube which is fixed in position by a mesial and distal pinch on the adjacent end tubing. In Fig. 4, *D* the slit tube has been passed over the twin wires and slipped back over the end tubing to rest against the elastic hook. When activated by the extraoral elastic, it causes distal force to be exerted against the elastic hook on the end tubing of the twin arch appliance.

A.



B.

Fig. 5.—*A,* Extraoral loops with slit tubes slipped on end tubing, exerting distal force on intermaxillary hooks. *B,* A more posterior view than *A,* showing coil spring acting on the maxillary right first molar.

The application of extraoral force by this method to a case under treatment is shown in Fig. 5. The twin arch appliance is modified in this case by the use of the Yost[13] sliding sleeve attachment on the anterior bands.

The headcap (Fig. 6) used with the above appliance consists of plastic tubing, one-half inch in diameter, which is supported by plastic belting material.[14] These materials are translucent and are not objectionable in appearance. More important, they may be assembled easily to make a headcap which is strong and comfortable. The plastic straps are fused together with a hot spatula. The two 0.050 inch looped wires with elastic hooks at their ends lie

partly within the plastic tube, connected by an elastic. This is done by engaging the elastic on one hook, then leading the elastic through the plastic tube on the hooked end of a long wire, and fishing the long wire and elastic out of the other end of the plastic tube. The elastic is then engaged on the other elastic hook. The anterior curved ends of the 0.050 inch wires prevent them from being pulled completely into the plastic tube when not in use. The extraoral elastic pressure is varied by selecting the proper size of elastic. The elastics are one-quarter inch in width and from seven to ten inches in length. The plastic tube fits around the head just below the occipital protuberance, the horizontal level being controlled by the plastic belting. If the horizontal level of the plastic tube is allowed to fall below the level of the twin arch appliance, a downward pull is developed which is transmitted to the four maxillary incisors. This is to be avoided unless we are dealing with an anterior open-bite case.

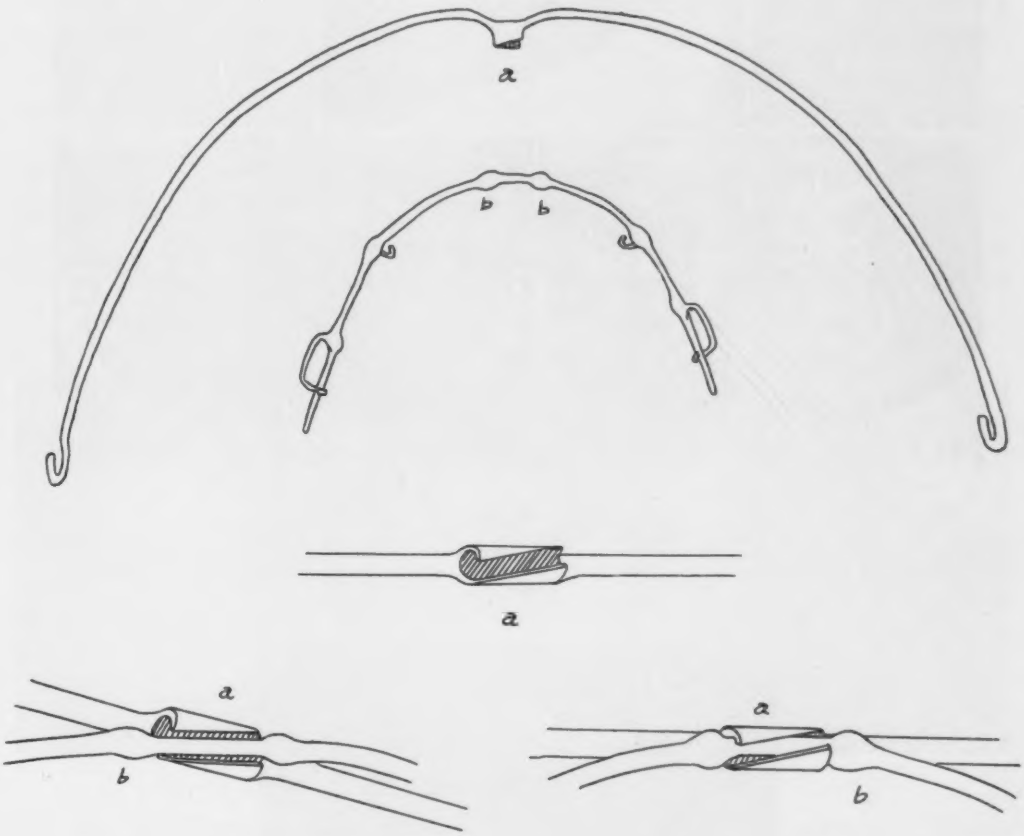
A. B. C.

Fig. 6.—*A*, Anterior view of patient with headcap, with extraoral loops emerging from cervical tube, curving around corners of mouth. *B*, Lateral view showing temporal plastic strap supporting cervical tube. Note the extraoral elastic within the tube, attached to the appliance. *C*, Posterior lateral view showing sagittal and temporal plastic straps supporting cervical tube.

If a decision has been made to treat a Class II case in the mixed dentition stage, mandibular anchorage becomes more of a problem. The anatomic form of the deciduous teeth and the resorption of their roots make them less desirable than permanent teeth for use as anchorage. Many orthodontists[15, 16] have treated these cases with extraoral force alone. It is feasible to use mandibular anchorage in these cases if very light intermaxillary force is used, and if it is replaced with extraoral force at night. It has been pointed out by a number of clinicians that the four maxillary incisors should not be banded at this stage because of the position of the crowns of the developing maxillary permanent cuspids. Distal force acting on the maxillary incisors may cause resorption of the roots of the permanent lateral incisors by the cuspids.

A lingual and a labial arch may be used to establish mandibular anchorage. A maxillary labial arch, adjusted to exert distal pressure on the first permanent molars, is modified to receive extraoral force. Fig. 7 shows a diagram of a labial arch and an extraoral bow which can be attached to it by the young

patient. The labial arch is 0.040 inch gold wire, with loop stops and intermaxillary elastic hooks. Encircling the wire, about 3/8 inch apart and equally distant from the mid-point of the arch, two small balls of solder are formed. In constructing the extraoral bow, a one-quarter-inch length of 0.042 inch (inner diameter) tube is soldered to the middle and parallel to a twelve-inch length of 0.050 inch stainless alloy wire. A disk is used to cut obliquely across the tube at a 20 to 30 degree angle. The width of the cut is increased to allow the 0.040 inch labial arch wire to pass through. The extraoral bow is then bent to follow the surfaces of the lips and cheeks. It is cut about two inches anterior to the ears, and upward curving elastic hooks are formed at each end.



A.

B.

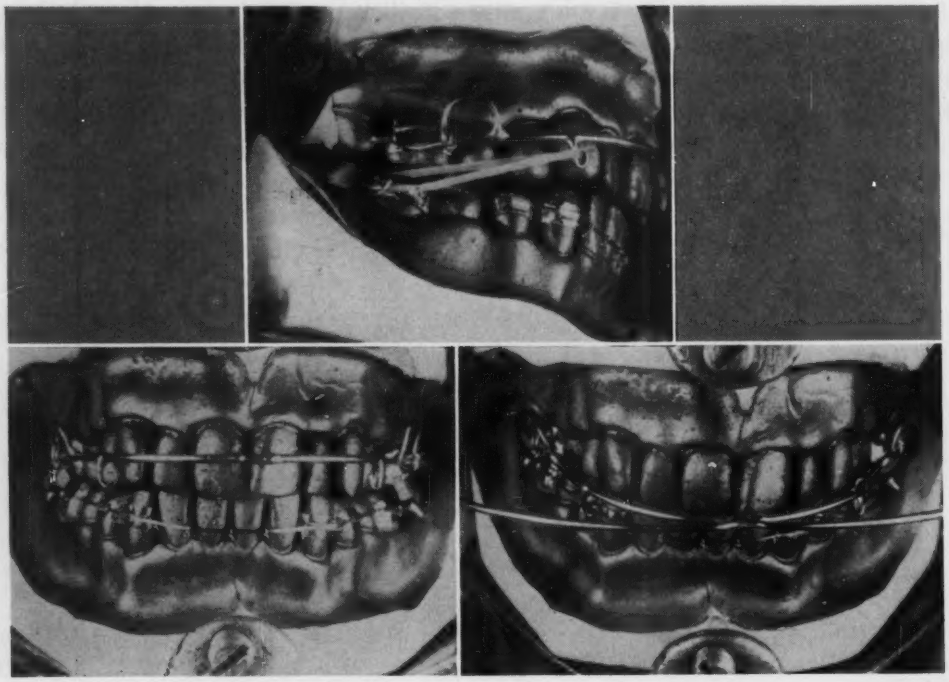
C. D.

Fig. 7.—*A*, Extraoral bow and maxillary labial arch showing slit tube (*a*) and solder stops (*b*) *B*, Detail of slit tube. *C*, Slit tube on bow being tipped at angle to fit over arch between stops. *D*, Slit tube locked into horizontal position on labial arch.

The labial arch is ligated to the maxillary first molars and adjusted so that force exerted on it will be active on the first molars. The horizontal level of the labial arch anteriorly should be at the commissure of the lips. Light intermaxillary elastic force is used during the day and discontinued when the extraoral bow is attached (Fig. 8). In attaching the extraoral bow, it is held by the patient so that the extraoral elastic hooks are up. The tube part of the

extraoral bow is placed against the labial arch between the two solder balls which act as lateral stops. The extraoral bow is tipped so that the oblique cut in the tube is parallel with the labial arch wire. The extraoral bow is then

A.



B. C.

Fig. 8.—*A*, Lateral view, maxillary labial arch activated by intermaxillary elastics worn by day. *B*, Anterior view of same arch, showing solder stops for extraoral attachment. *C*, Same as *B*, with extraoral bow in place, as worn at night without intermaxillary elastics.

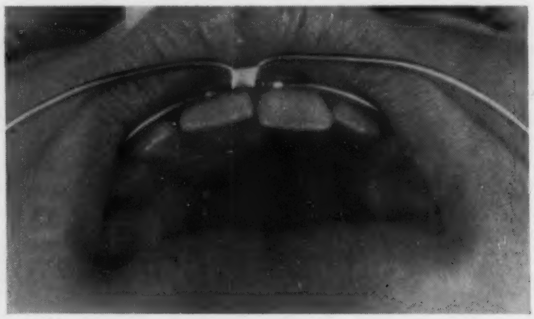


Fig. 9.—Extraoral bow placed on labial arch by patient.

slipped onto the arch wire and returned to a position parallel with the labial arch. This locking principle was adapted from the swirl tube band attachment used by Sved.[17] Fig. 9 shows a practical case in which the extraoral bow with slit tube has been attached to the modified labial arch.

A headcap made completely of plastic belting material is used with the extraoral bow method of applying extraoral force (Fig. 10). It consists of temporal, cervical, and sagittal straps, sealed together. The cervical strap is adjusted to lie just below the ear lobes. The headcap elastic hook is made of 0.020 inch stainless steel wire. Fig. 11 shows the various steps in its construction. A piece of wire two inches long is cut off and formed into a narrow, elongated U shape. The ends are heated and passed through the cervical plastic strap at the proper position, as shown in *A*. Two right angle bends are then formed in each wire, as shown in *B*. Heat is again applied to the cut ends of the wire and they are pulled up through the plastic strap, as in *C*. The long end is bent forward as in *D*. It is looped back to form the hook, as in *E*. The short, cut ends are bent down flat against the plastic to help secure the hook. Fig. 11, *F* shows another view of the finished elastic hook. The headcap elastic hook is placed so as to allow the extraoral force which will be produced to be in approximately the same plane as the labial arch. A downward component of force acting on the maxillary first molars will cause their crowns to be tipped distally. An upward component of force will cause the roots to be tipped distally. Extraoral force is produced by attaching elastics of the proper size between the headcap elastic hooks and the elastic hooks of the extraoral bow. Distal force may then be transmitted to the maxillary first molars. In this way, weak mandibular anchorage is subjected to less strain.

A. *B.* *C.*

Fig. 10.—*A*, Anterior view, extraoral bow attached to headcap. *B*, Lateral view, showing temporal and cervical straps and hooks for attaching elastic. *C*, Posterior lateral view, showing sagittal, temporal, and cervical plastic straps.

Orthodontic treatment of Class II malocclusions in adult patients is often made more practical by the use of a high labial arch. The type shown in Fig. 12, *A* is constructed of 0.050 inch stainless alloy wire, with intermaxillary elastic hooks. Solder stops are formed to act against the 0.050 inch (inner diameter) buccal tubes on the maxillary first molar bands. A lingual and a labial arch are used to establish mandibular anchorage. The high labial arch is worn with 2 to 3 ounces of intermaxillary elastic pressure during the day. At night the elastics and the high labial arch are removed by the patient, and a

labial arch soldered to an extraoral bow is inserted into the 0.050 inch (inner diameter) buccal tubes (Fig. 12, *B*). This is activated by extraoral elastics attached to a headcap of the type shown in Fig. 10. The amount of extraoral force may now be increased to 6 ounces without affecting mandibular anchorage. In the morning the labial arch with extraoral bow is removed by the patient and the high labial arch is inserted. The use of intermaxillary elastics

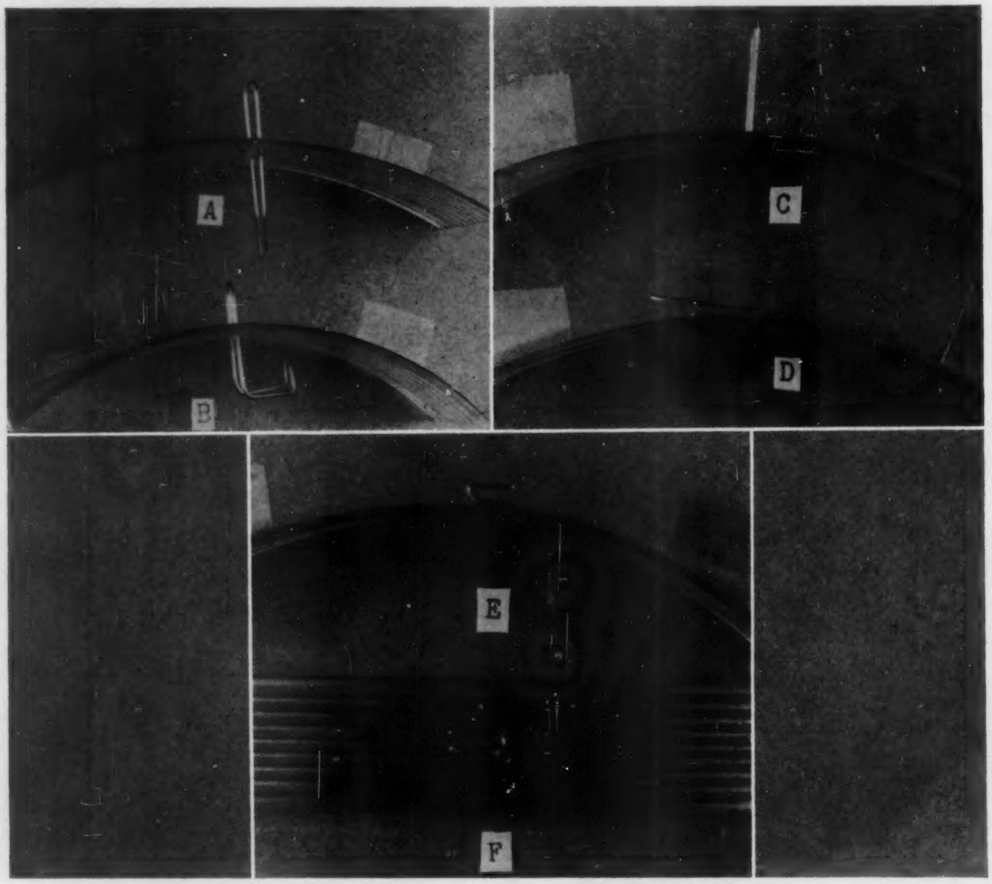


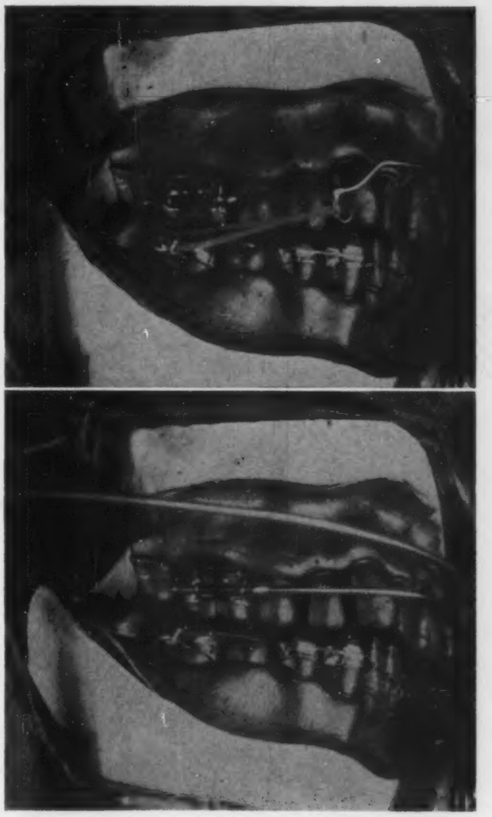
Fig. 11.—I, The wire has been heated and passed through the plastic strap, *A*; two right angle bends are made in the free ends of the wire, *B*. II, *C* shows the free ends after being heated and pulled through the plastic; at *D* the looped end is bent forward. III, *E* shows the looped end bent back to form the hook. The two short free ends are bent down flat against the plastic. *F*, Top view of the finished elastic hook.

is resumed. The more gingivally placed buccal tubes on the maxillary first molar bands in Fig. 12 are for use with the twin arch appliance after the molar relationship has been corrected, to align the anterior teeth.

Some Class II maxillary protrusion cases are disappointing in their response to routine Class II treatment procedures. In this category are cases with maxillary incisors which are not flared anteriorly, but which have a fairly vertical long axis, with no spacing. Some of these difficult cases have large maxillary second permanent molars and third molars developing. The treatment time generally is prolonged and mandibular anchorage is heavily

taxed. These cases may be treated with the twin arch appliance and extraoral force, applied with an extraoral bow soldered to a labial arch. Two buccal tubes are soldered on the maxillary first molar bands. The more gingival is 0.036 inch (inner diameter) for use with the twin arch appliance. The other tube is 0.050 inch (inner diameter) to accommodate the 0.050 inch labial arch that supplies extraoral force. The intermaxillary elastics are worn day and night with the twin arch appliance. Added to this at night is the extraoral distal force acting on the maxillary first molars (Fig. 13). The headcap used is of the type shown in Fig. 10. When coil springs are added on the end tubes of the twin arch appliance and activated, both the coil spring

A.



B.

Fig. 12.—*A*, High labial arch, with solder stop against 0.050 inch buccal tube of maxillary first molar band. Intermaxillary elastics worn by day. *B*, Labial arch soldered to extraoral bow replacing high labial arch at night.

pressure and the extraoral pressure act on the maxillary first molars in a distal direction. The anterior force of the coil springs is neutralized by the intermaxillary elastics. In this arrangement, mandibular anchorage receives no rest period. Because of the reinforced action on the maxillary dental arch supplied by extraoral force, however, the total length of time that mandibular anchorage must be used is reduced.

In a modification of the above method, elastic spurs are soldered to the 0.050 inch labial arch, opposite the maxillary cuspids. A light elastic is stretched across the elastic spurs. The elastic exerts pressure in a lingual direction against the labial surfaces of the maxillary anterior teeth, when the

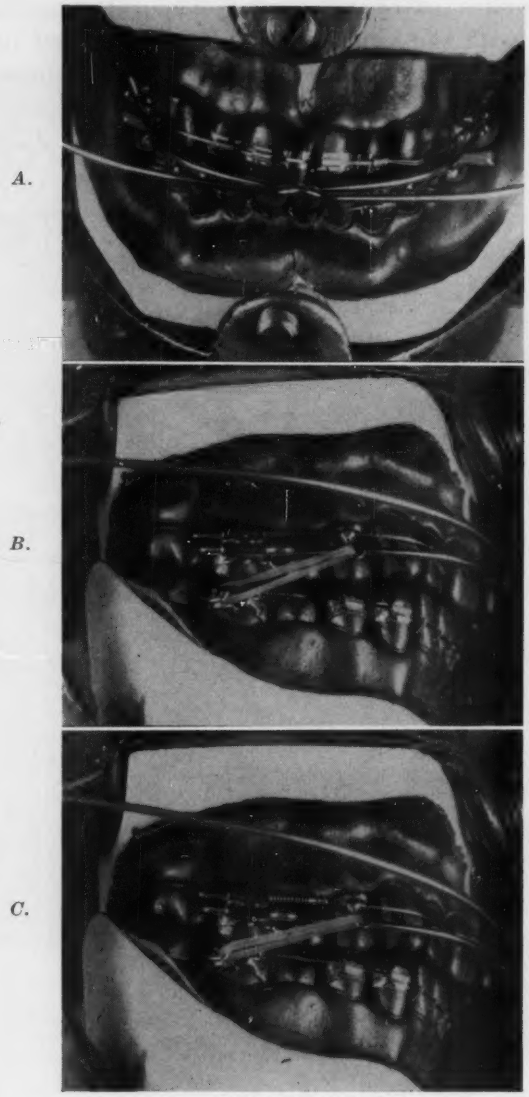


Fig. 13.—*A*, Anterior view showing twin arch appliance and appliance for extraoral force. *B*, Lateral view showing twin arch appliance activated by intermaxillary elastics, and labial arch soldered to extraoral bow. *C*, Same as *B*, with activated coil spring on end tube of twin arch appliance.

labial arch is in place, and when it is activated by extraoral force. It is then possible to discontinue intermaxillary elastics while extraoral force is being applied.

Fig. 14 shows a case at the beginning of treatment in which a single 0.010 inch wire is active on the four maxillary incisors. Extraoral force is being

applied to move the maxillary first molars distally. The usual sequence of steps of the twin arch technique will be followed. The beneficial effects of extraoral force will continue to be superimposed on this treatment.

Fig. 15 shows a different case which approaches completion, in which orthodox twin arch technique procedures have been followed. The aid given by extraoral force has lessened the over-all strain on mandibular anchorage.

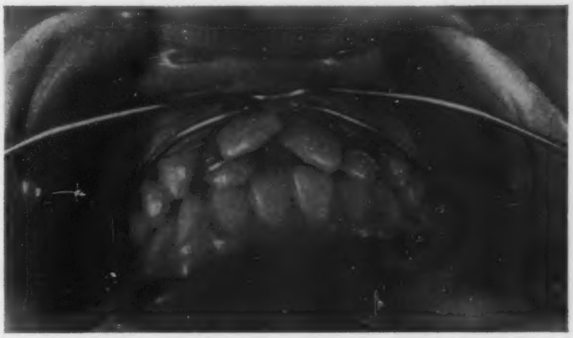


Fig. 14.—A case showing labial arch soldered to extraoral bow in place and 0.010 inch wire acting on maxillary incisors.

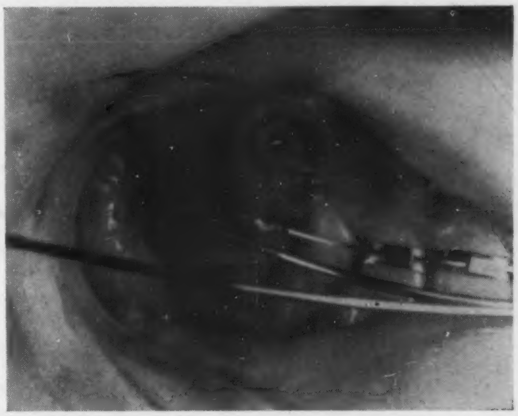


Fig. 15.—A case showing twin arch appliance working in conjunction with extraoral appliance.

In addition to its use as a direct force in moving teeth and reducing strain on mandibular anchorage, extraoral force may be used to reinforce mandibular anchorage. The extraoral bow and soldered labial arch may be adjusted to exert distal force on the mandibular first molars, to compensate for the mesial force produced by intermaxillary elastics. In the treatment of Class II cases, however, extraoral force is less efficient in its direct action on the mandibular dental arch than on the maxillary dental arch. This is accounted for by simple anatomic differences, the mandibular dental arch being situated on the movable mandible, while the maxillary dental arch is set in the stable maxilla. Furthermore, in Class II malocclusions, the maxillary dental arch is in a more favorable position in relation to the commissure of the lips than is the man-

dibular dental arch. This allows for the construction of a more efficient and comfortable maxillary labial arch which must connect with the extraoral bow through the commissure of the lips.

SUMMARY AND CONCLUSIONS

Changing concepts of diagnosis have resulted in a reappraisal of treatment procedures in Class II malocclusions. As the vulnerability of mandibular anchorage became evident, methods to protect it have been devised. This article sets forth some general principles regarding anchorage and stresses the application of these principles in treatment.

Modern orthodontic appliances, such as the Johnson twin arch appliance, can be modified by using older ideas of extraoral force to ease the strain on mandibular anchorage. Modifications of the twin arch appliance and the labial arch for this purpose are described. The appliance therapy used in several different types of cases has been shown here in detail.

It is not implied that the material presented covers all the problems connected with anchorage maintenance in the treatment of Class II cases. However, many problems may be avoided by a constant awareness that intraoral anchorage is subject to change.

The increased use of extraoral force will help reduce anchorage difficulties and contribute toward a high percentage of acceptable results in orthodontic practice.

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FROM "IRREGULARITIES OF THE TEETH" TO ORTHODONTICS AS A SPECIALTY OF DENTISTRY

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EACH of us owes something to those who preceded us, for from their experiences our profession developed to the level at which we found it. In return, we owe to those who follow us a better understanding of our own times and of ourselves. For that reason, I would like to consider the level at which I found orthodontia,* to present the tremendous changes and trends that have occurred during my professional career, and to mention those who were responsible for transforming "irregularities of the teeth" to orthodontics, a specialty of dentistry and medicine. It has been a long pull and the shift from the status of a simple mechanical art, known under many names, to what we trust is now an important specialized health service covers a considerable period of time.

DESIGNATIONS

It was not until 1843 that someone thought of defining the "dental art." Desirabode,[1] in his introduction, stated: "It is an art which no word expresses directly, but which we call *odontology* and *odontechney,* when confined to the study of the teeth, and *stomatonomy,* when it comprehends all the parts which comprise the mouth."

Years prior to the days of Fauchard, writers described the subject as "irregularities of the teeth." In 1836 Kneisel[2] began to speak of it as "malposition of the teeth." Since then the subject has enjoyed various designations, such as "orthopedia dentaire," "irregularities of dentition," "regulation of the teeth," "malocclusion of the teeth," "dental anomalies," "dental facial orthopedia," "orthodontia," and now "orthodontics."

In a series of three articles that appeared in the *Gazette des Hopitaux (Mars),* in 1839, Lefoulon, because he felt "irregularities of the teeth" to be an inadequate term, introduced a new designation, first suggesting "orthopedia dentaire" which he defined as "the treatment of congenital deformities of the mouth." This same designation was also used by Desirabode[1] and Talma,[3] and later (1893) was reintroduced by Calvin S. Case.[4]

In treating "facial orthopedia," Desirabode wrote: "We will append to this chapter, under the name of orthopedia, and in accordance with the true acceptation of the word, now much used and well understood, a series of means

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*The use of the words "orthodontia" and "orthodontics" will confuse the reader, as it was not until around the twenties that the latter word began to be used. I have, for that, retained "orthodontia" when quoting and applied to that period.

which, although requiring the application of the hand, cannot, nevertheless, be properly considered as operative surgery, inasmuch as they address themselves to conditions, which properly speaking are not diseases, such are the straightening, shortening and separating of the teeth." He then went on to define it as "the means of remedying irregularities of dentition and vices of conformation dependent upon the teeth."

Even at that time, much confusion must have existed as to just what did constitute the problems of orthodontics, for two years later (1841) Lefoulon,[5] for some unknown reason, remarked: "One point upon which we propose to dwell at length is *Orthodontosie*, vulgarly (and incorrectly) called 'dental orthopedia.' " By 1859 Lefoulon again had a change of mind and reverted back to his original designation.[6] In the meantime, Thomas E. Bond, in translating Lefoulon's work, dropped the "osie" so that it read "orthodontosy." Chapin A. Harris. in his *Dictionary* (1849), again modified the word to read "orthodontia" which he defined as "a part of dental surgery, which has for its object the treatment of irregularities of the teeth," and "orthodontic," defined as "relating to the treatment of irregularities of the teeth." Had not Lefoulon considered his original designation as vulgar, we probably would not have had the word "orthodontia" as a designation, a burden which it has been impossible to eradicate.

Sir James Murray, in 1908, feeling that *ia* meant a condition of being, introduced the word "orthodontics" as a noun, and shortly thereafter the English group began to be known as the British Society for the Study of Orthodontics. In 1912 B. E. Lischer, in his *Principles and Methods of Orthodontics* (published by Lea & Febiger, Philadelphia), for the first time in this country, made use of the word. When I used it as part of the title of the history[18] in 1924, much dissatisfaction was expressed upon the choice of the word, and it has been only within the past decade that "orthodontics" has been accepted officially in preference to "orthodontia."

Many since Lefoulon have attempted to define the subject, generally stating it to be "the correction of dental irregularities by the movement of malposed teeth to correct positions, the art and science of the treatment of malocclusion."[7] It would seem that all have failed, for our present definition lacks much of the objective and idea found in those expressed by Lefoulon, Desirabode, and Talma.

"LOVE OF BEAUTY"

"Love of beauty," Yard[8] once wrote, "is practically a universal passion." To this passion orthodontics owes a debt of gratitude, for the earliest records bearing on the teeth manifested a tendency on the part of the practitioner to take advantage of the love of beauty in emphasizing the importance of regular teeth as an adjunct to good looks.

Kingsley,[9] in 1858, imbued with the artistic sense of esthetics, argued that it is "most conducive to the beauty of the individual that all the permanent teeth should stand in the arch." Of course, this implies not only the relation-

ship of the teeth to beauty, but also the provision that it is most conducive to beauty to possess all the permanent teeth. He thereby raises his voice against the loss of any teeth, probably by extraction, as impairing beauty.

In his *Facial and Oral Deformities*[14] (1896) Calvin S. Case states: "A large proportion of all facial imperfections, which in many instances amount to actual deformities, are due to an inartistic relation of those features whose form and countour are governed by the position of the teeth and the peripheral surface of bone in which the roots are imbedded."

Edward H. Angle summed up the various opinions expressed in the seventh edition of his *Malocclusion of the Teeth* (Philadelphia, 1907, S. S. White Dental Mfg. Co.) in a few clearly stated propositions. Thus, "The mouth is a most potent factor in making or marring the beauty and character of the face, and the form and beauty of the mouth largely depends on the occlusal relations of the teeth." He then propounded a rule "in order that our efforts may be intelligently directed toward the ideal." It was "that the best balance, the best harmony, the best proportions of the mouth in its relation to the other features require that there shall be the full complement of the teeth, and that each tooth shall be made to occupy its normal position—normal occlusion."

The question as to what, then as now, constituted an ideal face was a problem for the individual practitioner. The type of face immortalized by the statue of Apollo Belvedere had been selected by Angle as a standard of facial beauty. Case's concept, as shown by the illustrations he selected, was quite different. Farrar and Kingsley, on the other hand, could not accept either of these. Many will recall the many contributions made by George W. Grieves and his intense interest in facial outlines as an orthodontic problem. Even at this late date there are "systems" founded upon the love of beauty, for as time went on esthetics, for some, became the basis of treatment.

EXTRACTION OF TEETH

Following the observation that teeth might be out of correct alignment came the consideration of how this might be corrected. From the earliest days in the history of orthodontics teeth were extracted as a routine procedure, permitting teeth to shift and migrate. Since about 1880 there has been a continual controversy as to the value of this procedure in orthodontic treatment. Trends developed as to just which should be removed—the molars, the cuspids, or the premolars—until extraction became unlimited. As a basic principle, one group advocated the removal of molars; others advocated removal of the premolars. In foreign countries, even today, many are advocating the extraction of not only the first four, but the second premolars and even some of the molars, as well—eight or more teeth, in all, as a compensating measure. Another group resorted to extraction of teeth only as a "compromise or last resort in treatment."

Isaac B. Davenport,[10] in 1887, strenuously opposed extraction "for besides the loss of important organs we shorten the bite, contract the mouth, disturb the facial expression and secure at least an arrangement of the teeth less

favorable for their preservation than existed before." He then went on to say: "By establishing normal occlusion we can hope to secure results in orthodontia."

Even Angle,[11] as late as his third edition in 1892, felt that extraction was justified, and a year later Case began the so-called premolar extraction wave. Subsequently, Angle accepted Davenport's ideas and brought forth his dictum of the full complement of teeth; he indoctrinated his pupils with it and the theory of normal occlusion of the teeth as the ultimate good in treatment. Upon this idea was founded the specialty of orthodontics. As the years went on, some of Angle's concepts have had to be modified.

Hellman[12] was among the first to show that what Angle called the "normal" was but an imaginary "ideal" occlusion. *"Nature's ideal,* as expressed in the form of type, was represented by the *average and its standard deviation."*

Upon the basic question of extraction of the teeth, orthodontics today seems to be just about back to where it started during the latter part of the last century.

THE PERIOD OF EMERGENCE

The Ninth International Medical Congress (1887) seemed to be the turning point, in this country, in orthodontic history,[13] for at that meeting Ainsworth, Angle, H. A. Baker, Bogue, Case, Farrar, C. L. Goddard, Guilford, Jackson, Kingsley, Magill, and Talbot met face to face for the first time. All were to play an important part, for the next several decades, in orthodontic history and activities.

The one paper that created the greatest discussion and dissension at the orthodontic session was that by Dr. Angle.[14] As reported, the discussion centered upon the question of priority of discovery, and not upon the value of Angle's proposed methods of treatment or the consideration of orthodontic principles. The last discussor, in closing, asked "whether the object of the session was to establish principles for guidance in the practice of the profession, or to establish the precedence of certain better inventions." How far-reaching was the influence of disunity regarding types of appliances and the question of extraction is something that only those who lived through this period know. It did have one desirable effect, however: it stimulated each to try and outdo the others. Thus, orthodontics did make some progress.

Of the above-mentioned group, Angle, Case, Farrar, Goddard, Guilford, Jackson, Kingsley, and Talbot each compiled the early textbooks. Later Canning, Chapman, Dalton, Dewey, Knapp, Lischer, Lukens, McDowell, Meier, Pullen, and McCoy and, even later, Anderson and Strang added others.

In reading the earlier texts, the over-all impression gained was that correcting "irregularities of the teeth" was based upon mechanics. As a result, "systems" developed; those better known bore the names of Angle, Brady, Canning, Jackson, Knapp, Lukens, McDowell, and Meier. Many only published small brochures (Knapp had as many as six editions), all keyed to their systems of appliances. These appliances could be obtained in "sets" at supply houses. They were well advertised as to the simplicity of orthodontic

treatment and as to how much the general practitioner was missing by overlooking such cases. In time this practice of selling such sets faded out, and the so-called "mail order" system entered the field.

Returning to the original group, Ainsworth had his own appliance. Henry A. Baker originated the "Baker intermaxillary anchorage." Bogue became an early advocate of expansion of the deciduous dental arch. Case had the idea that if there were more teeth in the dental arch than the alveolar process could accommodate, it then was necessary to extract. Kingsley,[9] who had contributed his first orthodontic article in 1858 and was the earliest to mention biologic implication of malocclusion with emphasis on the growth and development of dental structures, created the Kingsley splint. Magill originated the plain band, as well as the idea of cementing it to the tooth. Talbot[15] advanced some curious theories in that all malocclusion patients were either neurotics, idiots, degenerates, or lunatics. He undoubtedly had an idea, but unfortunately he failed to express himself clearly, for today we would not consider them as such, but rather as victims of some endocrine disturbance. His writings, therefore, should be read with this in mind.

As for appliances, it was a question of fixed versus removable ones, and in time one became known as an Angle, Jackson, or some other type of man. The fixed type of appliance (Angle system) was represented by the expansion arch, molar bands, plain bands, wire ligatures, and diverse minor accessories. The removable (Jackson) system of appliances consisted of a perfected "crib" originated by Delabarre[16] in 1819, and a modification of the W-shaped wire used by Coffin.[17]

The Angle system was a simplified, systematic course of procedure, involving mainly the principles of treatment as based upon Angle's classification of malocclusion, while the Jackson system consisted of a mechanical training in the making of appliances for the great variety of forms of individual manifestation of occlusal deviations. The former aimed at a general systematic order and arrangement with a view to facilitating educational methods, and the latter manifested a traditional attitude of individual instruction and specific application.

By a series of evolutionary steps, the traditional Angle system has evolved into the edgewise. Jackson's appliance has been modified into the Crozat and Gore removable appliances. The others of today are further modifications of either of those two.

SUMMARY OF THIS PERIOD

1. Esthetics was the basis of treatment. The type of face immortalized by Apollo had been one of the adopted standards of facial beauty.

2. The biologic concepts were as yet unknown.

3. The idea of occlusion had progressed from a consideration of the individual tooth to that of "occlusion as the basis of the science of orthodontia," although the relation of the teeth of opposing arches was spoken of as "articulation of the teeth."

4. A classification (Angle's) based upon the recognition of "normal," now known as "ideal," occlusion was accepted and did more than any one step to simplify orthodontics.

5. The deformity which had been known as "irregularity of the teeth" was now being termed "malocclusion of the teeth" and the name "orthodontia" was being given the new science.

6. The extraction of teeth was generally recommended.

7. Treatment was seldom begun or recommended until after the eruption of the permanent teeth.

8. The mechanical phase was the most important and was given the greatest attention.

9. "Prevention" had not been given a place in orthodontics.

10. "Systems" of treatment developed by individual men were the standard procedure, to the exclusion of all other methods.

11. Standardized appliances were to be had at the dental supply houses, with instruction as to their use.

12. Orthodontia was given little consideration in the curriculum of dental schools, and its teaching was of minor importance.

INSTITUTIONAL ORTHODONTICS

This year (1955) marks the one hundredth year of the birth of Edward Hartley Angle. Were it not for the genius of this master of orthodontics, perhaps there would not be the world-wide specialization and organization of orthodontists which we see today. In preparing this paper, therefore, it seemed appropriate to dwell especially on his influence and on the influence of his students, for no more outstanding personalities graced the list of any professional group than did those of the Angle School of Orthodontia.

At the end of the last century orthodontics was considered but an appendage of mechanical dentistry; for that reason, it received but scant attention by the deans and faculties of that day. No one person did more to foster orthodontics, to organize, standardize, systematize, and bring about its separation from the general practice of dentistry than did Edward H. Angle. From 1885 to 1892 Angle was professor of histology and comparative anatomy, as well as orthodontia, at the University of Minnesota; from 1892 to 1895, at Northwestern University; from 1896 to 1899, at Marion Simms College of Medicine and at Washington University in St. Louis, Missouri. From the experience gained while teaching in those institutions, he was convinced that, although dentistry and orthodontics both dealt with the human denture, they were fundamentally distinctively different sciences.

At the above-named schools, as well as the University of Pennsylvania, he had endeavored to interest the authorities in establishing a special department devoted exclusively to the study and practice of orthodontics.

He has written that, by 1899,[18] "I became filled with the belief that if orthodontia was to make any material progress, a separate school, entirely independent of dental school, must be formed which would provide opportunity for those with aptitude and liking for the subject to study it in a broad comprehensive manner, where it would be relieved from the blighting, handicapping influences which are necessarily thrown around dental colleges."

At just about that time, at the National Dental Association meeting at Niagara Falls, he was approached by Henry E. Lindas, Thomas B. Mercer, Herbert A. Pullen, and Milton A. Watson, with the request that he instruct them privately. Dr. Angle, upon considering the matter, finally agreed and had them assemble at his office in St. Louis, in November of 1899, for a brief three-week course. Convinced that Angle had much to offer, they then suggested that, instead of private instruction, it would be far more advisable that a permanent school be established whose chief aim should be the advancement of orthodontics.[19]

The experiment also convinced Dr. Angle that the time had arrived and, with the assurance that they would return the following summer to repeat the course and to aid him in instructing others, he began to formulate a course of study. With more applicants than he could take care of, he selected for the session in June, 1900, eleven men—Charles B. Blackmar, Frank A. Gough, Frederick C. Kemple, Henry E. Lindas, Lloyd S. Lourie, Thomas B. Mercer, Grafton Monroe, Herbert A. Pullen, F. W. Rafter, Richard Summa, and Milton T. Watson.

The establishment of the Angle School of Orthodontia laid the foundation of orthodontics as a specialty. In order to fulfill other requirements for an independent profession, Angle also realized the necessity of an organization, through which, by proper intercourse and interchange of ideas of persons with mutual interests, orthodontia could be further promoted. Therefore, in 1901, he organized the American Society of Orthodontists; to complete further his insatiable desire to further the interest of his specialty, he established (in 1907) *The American Orthodontist* an independent journal, wholly under society control, wherein the records, proceedings, and all topics of interest could be published.

Having himself specialized, he began, in 1896, to advocate the separation of orthodontia from general dentistry, thus fulfilling Farrar's prophecy, and by 1906 he no longer accepted anyone unless he agreed to specialize.

It is easy to understand that Angle's concept of a school (for he had taught real biologic orthodontics) met with almost organized antagonism, for it was a radical departure from the prevailing ideas of those who contented themselves with attempted correction of "irregular teeth." Out of this school, however, came the incentive for clearer knowledge and better understanding of this new department of dentistry.

Orthodontics owes much to those who graduated from the Angle School. For that reason, some of their names are recorded, most of whom you will recognize: Burt Abell; Rêne Anema of Paris, France; Louis P. Bethel; Glenn F. Bowman; J. A. Burill; E. Santley Butler; Samuel P. Cameron; Frank A.

Casto; Harold Chapman of London, England; Albert W. Crosby; Roscoe A. Day; Martin Dewey; Robert Dunn; Walter H. Ellis; Henry Clay Ferris; W. D. Flint; Wilson Foster; E. S. Friel of Dublin, Ireland; David Fyfe of Scotland; B. Frank Gray; George W. Grieves; Jacob Gorman; Frank A. Gough; Joseph Grünberg of Berlin, Germany; Charles A. Hawley; Milo Hellman; J. A. Cameron Hoggan; C. C. Howard; A. LeRoy Johnson; Harry E. Kelsey; Frederick C. Kemple; A. H. Ketcham; William G. Law of Berlin, Germany; Samuel J. Lewis; A. C. Lockett of London, England; Lloyd S. Lourie; Fred S. McKay; John V. Mershon; E. L. Mitchell; James and John McCoy; Frederic T. Murless, Jr.; Walter E. Newcomb; Frederick B. Noyes; Albin Oppenheim of Vienna, Austria; W. H. Pearson; H. C. Pollock; Herbert A. Pullen; Alfred P. Rogers; José J. Rojo of Mexico City, Mexico; Frank E. Sheldon; F. A. Stathers; Rulof B. Stanley; F. L. Stanton; G. B. Steadman; I. B. Stilson; Robert H. W. Strang; Richard Summa; E. W. Swinehart; Milton T. Watson; B. W. Weinberger; Oliver W. White; and J. Lowe Young.

These men lived and labored in what I would like to call the "formative period" of American orthodontics. Their lives were devoted to the intensive study of their specialty. Each, in his own individual fashion, built the very foundations on which the specialty rests.

Their unstinted devotion to the high ideals and principles of orthodontics as they thought it should be practiced during the days of "trial and error" stimulated research and teaching, developed orthodontic thought, and guided the direction that the specialty was to take. They found a true desire for learning and a willingness to give freely and often of one's personal knowledge. It was mainly they who changed the concept of just moving teeth into alignment with mechanical devices toward a biologic consideration of the problems involved. That the importance of this aspect was taking hold on all the leading men of the specialty can be seen if the literature is reviewed.

Factors in Bringing About a Change.—There were three separate factors of importance, as I view it, that brought about the tremendous changes during the next three and four decades. The first factor was the strict requirements that Angle required of his students upon entrance, for he once remarked that he desired his pupils to be "not merely good technicians, but real students, investigators and thinkers." They were accepted only after having first passed a satisfactory examination in biology, embryology, histology, and comparative dental anatomy, as well as the anatomy of the head and neck. Each year Angle added to the course such subjects as he believed important to the student of orthodontics. He advanced teaching in the subjects mentioned above, and in time there were added radiology, rhinology, art, photography, and zoology.

Those who succeeded in completing the course (many fell by the wayside) proved to be men of superior ability; they were the men who later played an important part in creating the specialty and directed the future path of the specialty. While some failed to see eye to eye on the problems of treatment,

they did absorb the spirit of investigation and creative thinking and they passed it on to others. It is clear that Dr. Angle felt that orthodontics should find its place within medicine and not in the dentistry of the time.

The Angle School continued to hold sessions until 1907 in St. Louis. In 1908 the class was moved to New York City, and then the school moved to New London, Connecticut, where it held sessions in 1909 and 1911. Because of Angle's health, it was discontinued. Dissatisfied with the teaching being given by others in the interval, he established, in 1924, his second school—The Angle College of Orthodontia—at Pasadena, California. The course was extended to one and then two years, and many of its graduates are among the present-day leaders. With the perfection of the edgewise arch, Angle felt that the passage of proper legislation controlling the practice of orthodontics was the next step. Realizing that an attempt to secure such legislation while the College was in progress would bring criticism, he, therefore, in 1927, discontinued his second endeavor.

As the Angle School could not supply the demand, other schools came into existence. The first was in 1907, when B. E. Lischer and C. D. Lukens of St. Louis founded the International School. This was taken over a few years later by William J. Brady and Hugh Tanzey and moved to Kansas City, where it continued until their deaths.

At the time Angle's health gave way, Martin Dewey, who had graduated in 1902 and then become a member of the faculty, began his own school in Kansas City. In 1915 he moved to Chicago and the next year to New York City. While it followed the ideas of Angle and was not a one-man school, it turned out many good men. Others endeavored to establish schools, but unfortunately they did not require the preliminary training, and they did not have the guiding spirit of Angle; for that reason, they never found their place in orthodontics.

It was the private schools that trained the orthodontists of the early twentieth century, in time gaining more prestige than the dental schools ever enjoyed. The attitude of the university schools toward orthodontics continued as Angle had found it. In the meantime, orthodontics had become the most vigorous specialty in dentistry. Beginning about 1906, the influence of the many men who had attended the school began to be felt in the dental colleges. One by one, the dental colleges added to their staffs the newer men trained in orthodontics; improved courses were being offered to undergraduates, but they were inadequate to prepare orthodontists to meet the demands for service.

Harvard was the first to recognize this situation, and, in 1916, established a special course; upon completion of the Forsyth Infirmary for Children, it transferred the teaching to the Infirmary. The Harvard-Forsyth combination lasted but four years, when the latter took it over. At the same time the University of Pennsylvania, under A. LeRoy Johnson, began a postgraduate course which was discontinued at the time Johnson left the university. It has been only within the past decade that universities have changed their attitude and now place stress on the subject.

Dr. Angle's death in 1931 brought to an end an interesting era in orthodontics; however, the impetus of his teaching and the spirit he instilled in others will be felt for years to come.

The second important factor was that the Angle School was never a one-man institution. Even with all his intensity, he found it impossible to teach and cover all the subjects that he desired his students to learn. With the assistance of earlier graduates, he gave the mechanics and the technique that he had mastered, which he knew would enable his students to carry out tooth movement successfully. Dr. Angle, although he had taught comparative anatomy at various dental schools, realized his limitations and, therefore, set about to find an outstanding comparative anatomist with the ability to convey that subject to his students. It was this spirit that led him to bring together a faculty of distinguished men. While his students recognized the importance of appliances, in some unknown manner those who constituted the faculty furthered the students' interest beyond the subject of teeth and inspired them so that they became investigators, entering into areas where "fools walk in, but wise men fear to tread."

The third factor, and the one which I believe had the greatest influence in bringing about the change, was the many active alumni groups, not only of the Angle School, but of the other schools as well. The general unity of ideas, seeing eye to eye on what constituted orthodontics, had expanded Angle's influence clear across this country and even into Europe. At one time there were some eight Angle alumni societies, some of which have become the present sectional societies of the American Association of Orthodontists.

Dr. Dewey,[20] in his presidential address before the Angle Alumni Society in 1906, stated: "Up to within a very late date orthodontists have been satisfied to have a very small space allotted to them in any dental meeting, and the cause of this is not far to seek. Orthodontia was not commanding of much respect as a science because it possessed so very little that was scientific. The recognition of occlusion as the basis of orthodontia by Dr. Angle marks a new era in the development of our specialty, which has reduced to law and order the chaotic work of the old orthodontists. It was this scientific development of orthodontia which marks the beginning of a new school.

"This society stands for more than the usual alumni society. . . . As the school is unique, so is this society. It should exist . . . for the advancement of orthodontia as a specialty and science. . . ."

Of the alumni groups, undoubtedly the Eastern Association of Graduates of the Angle School of Orthodontia was the most vigorous, taking a conspicuous place in the history of the progress of orthodontics as a serious-minded, purposeful group that made some of the most important contributions to the recorded literature of the subject during the first third of this century.[21]

These alumni groups, each having a small membership, while working separate and apart, all had a common purpose. Except for a case report or a clinic, mechanics was seldom a part of the society meetings, each of which was devoted to a problem closely related to orthodontics such as abnormalities of growth, ankylosis of the jaw, artificial feeding of infants, biology, body and

facial growth, bottle feeding, children's diseases, anthropology, comparative anatomy, development of the teeth, facial and muscular structures and deformities, embryology and histology, education, endocrinology, etiological factors, evolution, diet, genetics, habits, harelip and cleft palate, heredity, metallurgy, nomenclature, nutrition, orthopedics, perversion of forceps, prenatal factors, rickets, skeletal adjustments, and uterine effect. Few of these subjects had ever been considered in dentistry until introduced by an orthodontic group, something for which dentistry has never given credit to orthodontics. Thus, orthodontics aided materially in changing the concept of dentistry from a mechanical art to what is now recognized as a learned profession.

The effort to improve the status of the specialty came step by step. While aid was sought from artists, anthropologists, anatomists, biologists, pediatricians, oral surgeons, and many others, orthodontists in turn had a part in stimulating them, enlarging their own special fields, thus furthering their interests.

Before the Angle Alumni Society, in 1905, Richard Summa[22] remarked: "Not only should the fellowship thus called forth promote the high ideals to which our Alma Mater aspires, but it is hoped that every member shall contribute, by further elaboration of these principles, to the scientific advancement of the specialty for the practice of which this school prepared him." Let us see just how this call was fulfilled.

This began a new era in orthodontics, and it is surprising to see to what extent and to how broad a scientific advancement it did develop. At that meeting papers were read by Henri Hus[23] and George Lefevre[24] on "Inheritance of Acquired Characters" and "Heredity and Environment." The realization that the fertilization of the original chromosomes may have something to do with irregularities of the teeth, as it does with the color of the hair, the eyes, or the shape of the nose or ears, opened up an entirely new approach and showed that the answer to our problems did not lie entirely in skillful manipulation or types of appliances, for the scope of orthodontics was destined to be something more important and comprehensive.

This began the urge for freedom of thinking and individual endeavor, as well as the desire to explore related subjects, that permitted men to allow their enthusiasm and imagination to wander into a wider area of study. As time went on, Hellman, A. LeRoy Johnson, and many others started to talk and write about genes and genetics, Mendel's law, and the laws of others, so that things began to clear and one became more scientific in his point of view.

Rhinological Era.—As far back as 1904, Dr. Angle[25] felt that there was "a close relation of malocclusion of the teeth and diseases of the throat and nose which necessitated an intimate knowledge of this region. "Hence, he introduced a course of lectures on rhinology, in which Dr. W. E. Sauer of St. Louis was the instructor. In 1907 Dr. Sauer[26] read a paper entitled "Orthodontia From the Rhinologist's Standpoint." This was the beginning of the traditional adenoid and tonsil era in orthodontic diagnosis and prognosis. By 1912 this phase had become so important that the American Laryngological,

Rhinological and Otological Society held a special meeting in Philadelphia, devoted to the subject of orthodontia; they also devoted the entire November number of their society publication, *The Laryngoscope*,[27] to it. Their principal speaker was Dr. G. V. I. Brown of Milwaukee. He described how, over a period of years, he had expanded the maxillary arch with spectacular results. A. H. Ketcham[27] considered "Treatment by the Orthodontist," presenting documented and illustrated cases showing the changes in the nares and the lowering of the floor of the nose.

The remarks of Frederick B. Noyes[29] about sum up the situation at that time: "To do their full duty by their little patients the rhinologist and the orthodontist must work together, for the work of one supplements that of the other. In many cases the efforts of one are practically useless without the aid of the other. Failures in establishing normal breathing through adenoid operations may be made successful in the majority of cases by the intervention of the orthodontist. The orthodontist, by gentle pressure, moves the maloccluded teeth into normal positions and relations; stimulates bone development, increasing the size of the maxillary bones and nose cavity. By causing normal development of the maxillary arch, the roof or vault of the mouth, and floor of the nose, a deflected or "S"-shaped septum—when hypertrophy, ledges, spurs are not present—is often corrected, in our young patients, and benefited in the older. In order to receive full benefit from orthodontic treatment, about 50% of the orthodontist's patients require the service of the rhinologists. . . ."

Dr. Mershon had been asked for the cooperation of the Eastern Association of Graduates of the Angle School of Orthodontia in holding a symposium. Those participating were Hellman on "Topographical Anatomy," Stanton on physiology, Young and E. Santley Butler on treatment, and myself on a bibliography of the literature. This has now become of historical importance. At about the same time, W. H. Haskin,[30] before the section at the New York Academy of Medicine, read a paper on the "Relief of Nasal Obstruction by Orthodontia," in which he had the cooperation of Bogue and George Palmer. Papers by Herbert Pullen, Varney Barnes, and others appeared in both medical and dental journals.

However, it was the demonstration by Stanton, at the Philadelphia meeting, of a wet skull, to which a jackscrew had been applied from molar to molar, that upset the "applecart." He proved that the opening of the maxillary suture could not be separated.[31] From that day on, less and less was heard on the subject. While it lasted, it had a great impact on the members of the new specialty and was the beginning of a closer cooperation with the medical profession.

Introduction of Applied Sciences.—In the meantime, F. B. Noyes' interest in, and teachings of, dental histology at the school was beginning to bear results. In 1911, Albin Oppenheim,[32] then of Vienna, presented the first of his papers on "Tissue Changes Incident to Tooth Movement," a subject that continued to command his attention until his death in 1945. At the same time, Bernard

Gottlieb gathered around him in Vienna a group whose main interest was the study of dental histology. All his students later played an important part in advancing our knowledeg of the subject.

Rather than mechanical procedures—appliances, screw threads, and nuts—more emphasis began to be placed on the life processes and an endeavor to see malformations in the framework of the total person. The earnestness of the efforts to learn and bring to light such facts as would help orthodontics had reacted so favorably that men with scientific training and knowledge in correlated sciences began to take an interest, and cooperated whenever and wherever approached.

It was the teaching and inspiration of Raymond C. Osburn and Henry Fairfield Osborne that inspired Hellman and he, in turn, Gregory, Boas, Hrdlicka, McGregor, Todd, Krogman, and others; thus, our understanding and knowledge in physical anthropology and paleontology advanced. No one in anthropology had paid attention to the occlusion of teeth and dentition of man and animals until orthodontics focused attention upon the subject. Today these subjects have become a part of the anthropologists' intensive studies. Others, such as Brash, Hooton, and Keith, in time became interested and the study of growth, development, and physical treatment progressed enormously.

In 1907 Hawley, influenced by Angle's concept of the perfection of occlusion and of the arrangement of the teeth, developed his charts based upon Bonwill's arch as the standard in determining the size of the arch by measurement of the anterior teeth. This was an early attempt at predetermination.

After Hellman had shown Angle's "normal" occlusion to be an "ideal," some began to question that the first permanent molar always erupted in its proper place in the cranium and, therefore, decided that malocclusion could not be classified according to the position of these teeth. For a time, Simon's diagnostic theory of gnathostatics made quite an impact on theories of diagnosis. Various other proposals were advanced which ultimately led to the efforts of Todd and Broadbent. The Bolton standards and technique in orthodontic practice, introduced by Broadbent and Brodie in 1913, have developed into the present-day cephalometric concept of growth and so-called treatment.

In 1912 Stanton arranged for a course of eight weekly lectures on pediatrics to be given by Dr. Oscar Schloss at Cornell Medical College. Others took courses in biology under Morgan at Columbia and Goldfarb at City College. These led to Kelsey's inviting McCollum to discuss the problem of nutrition. The questions asked of McCollum were such that he admitted they were beyond him but he said that, if permitted time to think them over, he would return with an answer. This he did a year later, bringing his new concept of nutrition. In time he was followed by Shipley, Hess, Parks, Schwartz, and others. This was the introduction of the subject into orthodontics and then into dentistry.

In 1911, Hellman, as editor of *The American Orthodontist,* quoted Socrates as saying: "Gentlemen, we are not interested or arguing whether you or I am right; what we wish to ascertain is the truth of the question before us." It

was with that spirit that orthodontics began its change. Hellman's[33] important contribution, in 1911, was entitled "Bone Tissue, Its Growth and Development. A Résumé." In 1920 he offered the first paleontologic analysis of Angle's classification. Following this came his studies of the human denture and face. Hellman found, and it has since been confirmed by Broadbent's and Brodie's studies, that the individual type was determined very early in development and that it could not be changed fundamentally, for orthdontics was a problem of growth and not just the movement of teeth by mechanical appliances. In 1921 he introduced the concept of "standard deviation" and "error of the difference,"[34] and in 1931 he introduced what he called "wiggles."[35] The use of these methods has since been widely adopted.

In this country, little attention had been paid to the subject of endocrinology until 1915, when Hellman brought to our attention the experimental work on animals by Biedl and Kranz.[45] At that time he remarked: "Of the numerous factors that enter into the etiologic problem of malocclusion of the teeth, *internal secretion* is the one which may, in a large measure, account for many mysteries that perplex the orthodontist." This led such men as Bates, Berman, Bisch, de Bosaniji, Janney, Sailor, Swingle, Timme, Englebach, and Elkinn to discuss this problem before orthodontic groups. The latter, upon recognizing certain types of malocclusion as classical symptoms associated with the syndrome of glandular disturbances known as acromegaly, interested Clint Howard in doing some research work at the Good Samaritan Clinic in Atlanta, Georgia. Out of this came "Howard's syndrome" and the coinage of the term "acromegaloid growth." The syndrome, Howard stated, "is characterized by certain physical markings; a lower jaw that protudes, a long obtuse angle formed by the ramus, and a horseshoe body that is decidedly obtuse." His observation that "the first and most important information necessary for a sensible orthodontic diagnosis is the general visual survey of the child as an entire physical individual" showed that certain types of malformations could not be treated by appliances, for they were but symptoms of disease. Class III cases of malocclusion then became highly speculative.

In May, 1915, Stanton introduced his "engineering principles." This brought forth the problem of predetermination of the dental arch, the forerunner of many such instruments.

By 1918, study and discussions had indicated that occlusion of the teeth was not the whole problem and that the tissues supporting and surrounding the teeth played an important part in treatment. Alfred P. Rogers began to consider the development of the face with a view to increasing myofunctional therapy, making the muscles act as an orthodontic appliance.

It was in the same year that Mershon demonstrated the use of the lingual removable arch that is now so closely associated with his name. The following year Hawley introduced his retainer.

Frederick Kemple was among the earliest to speak of early treatment and to claim that if some cases being treated had been left alone they would have developed, as a result of growth, to a point where treatment would not have been necessary.

In 1919 LeRoy Johnson's[37] epoch-making paper, "The Individual Normal—The Problem of Orthodontia," dealing with normal tooth variations, became one of the important turning points in orthodontic practice; however, the abuse of this principle led to a wave of extraction. His "Orthodontic Education,"[38] presented the next year, approached the study of malocclusion in the light of correlative variation, which developed into his "Basic Principles of Orthodontia;"[39] thus, biology became the important phase, as opposed to mechanics.

J. Lowe Young's studies, on the third molars (1920), in which he proved that many that were thought to be impacted would eventually erupt, were later confirmed by Broadbent. Young[40] was the first to call attention to traumatic occlusion, in a paper read in Australia in 1923.

Other investigations and developments worth recalling are H. C. Ferris' studies of the human saliva and Lawrence Baker's work on the influences of the forces of occlusion on the development of the bones of the skull, as well as his efforts at Harvard in education. Crosby's introduction of the first orthodontic record charts in 1907, intended for the gathering of information and a study of cases, was the initial effort for scientific data. It was his interest at Yale that helped inaugurate that institution's interest in dentistry.

Dentistry's present relation with the Bureau of Standards is the result of Kelsey's initial contact during World War I to aid in supplying the orthodontist with suitable material. As a result of his request for Johns Hopkins' essayists for our orthodontic meetings, he became closely associated with it. Murless' paper on "Some Properties of Metals" (1922) opened the way for the substitution of platinum and platinum-irridium in orthodontic appliances, and there began a series of new formulas.

In 1926 Broadbent, under Todd, began the investigation on the orbital plane and in 1931[41] introduced his "new x-ray technique," which was more accurate and permitted the gathering of a greater amount of information in three planes of space. Among the first to become interested in the Broadbent-Bolton cephalometer was Allan G. Brodie. Since then, others have become interested in and utilized this method to advance the findings on the growth pattern of the human head.

By the time the First International Orthodontic Congress was held in 1926, the influence of our European colleagues (Chapman, Lockett, Friel, Lundström, Matthews, and many others) had become an important factor in orthodontic progress. Root-moving appliances, introduced by Case, had brought about many "philosophies," and one of the most talked of ideas was Lundström's apical base and its importance to tooth movement.

The important contributions made by orthodontists to the public health service during World War I must be mentioned. It was the efforts of Joseph Eby and Guy Hume, as associates of Robert Ivy, that led to the amazing contributions to the repair of head and face injuries of our veterans. Oren A. Oliver and others have served as members of various state health departments. F. S. McKay, who had acted as director of the Angle School in 1905, 1906, and

1907 and thus had absorbed Angle's interest in science, undertook the investigation of the problem of mottled enamel that has ultimately led to the fluoridation of water.

Other scientific studies have been made. In this manner, I have endeavored to trace the changes, the development of ideas and ideals, and the trend and direction of the movement from "irregularities of the teeth" to that of orthodontics as a science and a specialty. There remains, however, another important factor that cannot be overlooked.

Of this period, orthodontic history was written in the pages of such journals as *Dental Items of Interest, The American Orthodontist, Dental Cosmos, The International Journal of Orthodontia,* and *The Angle Orthodontist.* The publication of papers reflects a richness of tradition, a tenacity of purpose, and an epoch of history in which an important specialty was born. The orthodontic profession, therefore, owes an everlasting debt of special gratitude to five men who edited those journals—Rodrigues Ottolengui, Edward C. Kirk, L. P. Anthony, Martin Dewey, and H. C. Pollock—and to another outside dentistry—Dr. C. V. Mosby—who did more than any other person to keep alive the modern concept of orthodontics, for upon the demise of *The American Orthodontist* he took the risks to establish an independent orthodontic journal.

Through the medium of journalism, we were brought into direct contact with allied sciences, thus permitting orthodontics to find its way into the libraries of important scientific organizations. Like social changes, professional evolution cannot be accomplished in a few years. Those who were instrumental in founding "orthodontia" and later the specialty of orthodontics labored for the best interest of all. They were the torch-bearers of a wider knowledge, the aid to the teaching of a nobler science, and ever an inspiration to better treatment and practice.

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In Memoriam

J. CAMP DEAN*

THE passing of our retired and beloved member, J. Camp Dean, aged 76 years, in his Oakland home after a long illness, brings sorrow to all, as he was a man of many virtues.

A native of Wisconsin and a graduate of the University of California in 1910 and the Dewey School of Orthodontia in 1914, he was a past-president of the Pacific Coast Society of Orthodontists, the California State Dental Association, and the Alameda County Dental Association.

His affability and warmness won friends for him in all walks of life. His love of games made him a favorite at the University Club of Alameda County. Handicaps were easily forgotten, for at an early time in his life, when he had the misfortune to lose a leg, through perseverance and training he became an expert at bicycle riding with an artificial substitute. He went out to help others accept and adjust to similar misfortune.

As a general practitioner of dentistry and then as an orthodontist, he counseled his younger colleagues, assisting them in establishing a practice, always encouraging high standards, and developing a program of continuous study.

He established the first orthodontic clinic for underprivileged children at the Children's Hospital of the East Bay area. Also, he participated actively in the Rotary Club's philanthropic activities for crippled children.

Dr. Dean, whose death is a loss to both his community and our profession, will long be remembered by those who were so fortunate as to be his colleagues or friends.

Surviving him are his wife, Mae, and his two sons, Douglas of Los Angeles and William B. of Oakland, to whom our sincere sympathies are extended.

CHARLES A. SWEET, SR.
REUBEN L. BLAKE

ELDON E. HARRIS

1905—1955

THE members of the Southwestern Society of Orthodontists were recently saddened by the death of one of their respected colleagues, Dr. Eldon E. Harris, who died on Nov. 25, 1955. He had practiced in Austin, Texas, for twenty-eight years.

*Reprinted, with revisions, from the *Bulletin* of the Pacific Coast Society of Orthodontists.

Dr. Harris was born Sept. 24, 1905, in Lockhart, Texas. He attended high school in Lockhart and was graduated from Baylor University College of Dentistry in 1927.

He was quite active in civic and professional life, being a member of the Austin District Dental Society, the Texas Dental Association, the American Dental Association, the Southwestern Society of Orthodontists, and the American Association of Orthodontists. He was also a fellow of the American College of Dentists. He served as secretary-treasurer and as president of the Austin District Society; he had been chairman of the legislative committee of the Texas Dental Association since 1946; and he was representative to the advisory committee of the Board of Texas Hospitals and Special Schools for the past three years.

Dr. Harris was married to Miss Louise Wilson in 1931. He leaves his widow; two sons, Robert Eldon Harris and Steven Wilson Harris; his mother, Mrs. Edgar Harris; and a sister, Mrs. Weldon Adair. The sincere sympathy of all the members of the Southwestern Society of Orthodontists has been expressed to them.

Necrology Committee
John Conly
Harrell Delafield
Frank Roark, Chairman.

Correspondence

The following information was contained in a letter from Dr. B. W. Weinberger of New York. It is thought that this painstaking explanation will be of interest to librarians, historians, and many of the readers of the AMERICAN JOURNAL OF ORTHODONTICS.

In the article by Dr. Earl W. Swinehart (AM. J. ORTHODONTICS **41**: 930-933, December, 1955), there is a quotation from page 931 of my *Orthodontics, An Historical Review of Its Origin and Evolution* (published in 1926 by The C. V. Mosby Company). At that time I stated (p. 677) that Angle's "Irregularities of the Teeth" (Ninth International Medical Congress), 1887, was probably the first Angle edition.

As considerable confusion exists as to just which work was his first edition, I would like to correct the error I then made. It was in a conversation with Dr. Angle in 1924 that I learned that he considered the paper he read before the Congress as his first edition. As I had a reprint of the paper (565-573) in my collection, I presumed that the information was correct.

Dr. Angle, before the Minneapolis Dental Society in December of 1885, first presented to the dental profession his views regarding the treatment of irregularities of the teeth. In July, 1886, he enlarged upon these ideas in a paper presented before the Minnesota State Dental (not Medical) Society, where it was received with much favorable comment. He then was asked to repeat the paper at the Ninth International Medical Congress in September, 1887, and did so under the title of "Notes on Orthodontia, With a New System of Regulation and Retention."

Soon after the publication of my history, I came across the first edition of Haskell's *Students Manual and Handbook for the Dental Laboratory* (1887), and found therein, on pages 66-79, that this same paper had been reprinted. In Haskell's second edition (1890), Dr. Angle revised and enlarged his paper, which became chapters 22 and 23—"The Angle System of Regulation and Retention of Teeth" and "Fractures of Maxillary Bones." In this edition, on page 66, Dr. Angle states that he considered the chapter in Haskell's first edition to be his first. Therefore, listing the article as published in the Transactions of the Ninth International Medical Congress as his first was an error.

The two chapters in Haskell's 1890 edition were then issued as a self-contained work under the title of *A System of Appliances for Correcting Irregularities of the Teeth*, and was marked "second edition."

For the benefit of librarians and those interested in this phase of Dr. Angle's activities, I desire to clear up this confusion. Only lately, Miss Palmer, librarian at the Dental School, University of Pennsylvania, brought this same reference to my attention and mentioned that she had found the correct answer to be as now related.

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Department of Orthodontic Abstracts and Reviews

Edited by

DR. J. A. SALZMANN, NEW YORK CITY

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

Time to Tell: A Comment on Orthodontic Orthodoxy and Other Essays. By Benno Edward Lischer (with a foreword by Alfred P. Rogers). New York, Vantage Press, 1955, 105 pages. Price, $2.50.

Lischer, the recipient of the Ketcham Award in 1951, has taken *Time to Tell* some of his experiences and philosophy after a half-century on the orthodontic scene. This little volume is not a collection of the idle musings of a man who finds himself with time on his hands, but is the distillation of the beliefs and philosophy of one of the most literate and erudite personalities to grace the specialty of orthodontics. Anyone who reads this book will find inspiration and information which stem from the mature mind of a man who has something to say, knows how to say it and, above all, is not afraid to say it.

Among the fancies and foibles of orthodontics which Lischer reduces to size we find "orthodontic orthodoxy." This is more commonly known as "the system" or even "the philosophy." "Fortunately," says Lischer, "orthodontic orthodoxy, like religious orthodoxy and the reign of monarchies and kings, is on the way out. We now realize that orthodoxy is a handicap on thought, that it usually *places emphasis on nonessentials."*

Lischer translated Paul W. Simon's "Diagnosis of Dental Anomalies," which elucidates gnathostatics. This he rightfully recognizes as the forerunner of present-day roentgenographic cephalometrics. The difficulty in getting his translation of Simon's book published and the mixed reception it received after its publication make interesting reading and provide a sidelight on "orthodontic orthodoxy" plus chauvinism.

Lischer's plan on dental education which is presented in outline, deserves the attention and study of dental educators. Dentistry would do well to adopt Lischer's plan.

Lischer was decidedly not one of Angle's disciples. Nor does he spare Angle in this book. He finds Angle's approach to be based on static mechanics, while Lischer sees orthodontics as a specialty which deals with a dynamic problem in an area which is infinitely fluid in nature. The measurement of dentofacial deviations in accordance with accepted norms is Lischer's sine qua non. He calls on orthodontics to "eliminate the many *contradictions* and *assumptions* of our art and science."

Extraction as an adjunctive procedure in orthodontic therapy is recognized by Lischer, and he points out that it dates back at least to Fauchard (1728). However, he feels that, ". . . conditions which justify such action (extraction) occur very rarely."

Lischer believes that patients come to the orthodontists because of "their parents' strong desire to make them more beautiful men and women." There-

fore, it behooves orthodontists ". . . to understand beauty, its inner meaning, its relation to life."

Readers of this book will find a wealth of quotations and references to writers in many fields who have helped Lischer to shape his philosophy of life and to maintain a healthy respect for dentistry as a profession. It is a good book that Lischer has written. One wishes it were longer. The book will be a delight to Lischer's friends and will prove interesting to those who have not had the good fortune to know him personally. The man Lischer is a man worth knowing.

J. A. S.

The Importance of Genetic and Non-Genetic Factors in the Facial Skeleton Studied in 100 Pairs of Twins. By Anders Lundström. From the 1954 *Transactions of the European Orthodontic Society.*

This paper constitutes a preliminary report on a lateral cephalometric x-ray examination of 100 pairs of twins, fifty identical and fifty fraternal, the members of each pair being of the same sex. The purpose of the investigation was to study the relative importance of genetic and nongenetic factors to the skeletal pattern of the facial profile. This study has been restricted so far to the sagittal variations.

An attempt has been made to analyze the significance of finger-sucking to malocclusion of the teeth. The greatest difficulty in this connection is in effecting a reliable registration of the habit. Where finger-sucking was practiced by the twins, it had ceased in most cases several years before the investigation, so that the mothers' memory was unreliable in respect to the period that the habit lasted and its intensity.

In 40 to 50 per cent of the pairs, at least one of the twins was declared to have been a finger-sucker at some period. Similarity in respect to the occurrence and duration of the habit was found considerably more often in the identical than in the fraternal twins, a fact that suggests that a disposition to the habit is to some degree hereditary.

From the etiological point of view, particular interest attaches to the identical pairs for which large dissimilarities in the habit were obtained. Of the two identical partners in the only case of triplets in the study group, one had never sucked her fingers, while the other had sucked her thumb until the age of 8 years. On the occasion of the examinations, when the children were 9 years old, both had an overjet of 3 mm., while the overbite was 1.5 mm. for the former and 0 mm. for the thumb-sucker. The molar occlusion was normal on both sides in the former, and normal on one side and postnormal on the other side in the latter. Another pair with differences in the finger-sucking habit (one twin without and the other with finger-sucking until the age of 6 years) exhibited similar overbite (0.2 mm.), while the overjet (2.5 mm. and 5.5 mm., respectively) and the molar occlusion (bilaterally normal for the first and postnormal half cusp width on one and one cusp on the other side for the finger-sucker) presented differences that may have been due to dissimilarities in the finger-sucking habit.

Among the fraternal twins there are four pairs with rather pronounced differences in the habit (one twin not sucking, and the other twin in each pair sucking until 14, 13, 10, and 10 years of age, respectively). No consistent effect of the habit could be detected.

Three pairs (identical) had continued the habit until the age of 8-9, 11, and 10-12 years; the examination was performed for these pairs at the ages of 15, 13, and 15 years, respectively.

The overjets for these pairs were (for the first and second twins, respectively): 4.0 and 4.5, 4.3 and 3.0, 2.0 and 2.0, while the overbites were 4.7 and 3.2, 4.0 and 3.0, and 1.5 and 0.9 mm., or averages of 3.6 and 2.9 mm. These values are by no means remarkably high.

In no case where the habit was particularly prolonged was there any marked deformation. This does not mean that in such rare cases where the habit is of greater duration or more intense than observed in this study group the dentitions may not present a rather marked effect.

The statistical analysis of the data referring to the importance of genetic and nongenetic factors to the skeletal facial profile was performed according to the procedure evolved by Dahlberg in 1926 and 1942.

It seems probable that the so-called internal environmental factors, active mainly in early embryonic life, play quite an important role in this respect. Such factors have nothing to do with environment in the usual sense of this word, but can be maintained to give an expression of the lack of precision of the genes. Considering the extremely complicated development of the body, one can hardly expect that even if we could give two genetically identical individuals the same external environments, they would develop exactly alike.

The foregoing calculations refer to the conditions in a group of twins, and the extent to which they may apply to the population as a whole remains to be determined. Knowing the difference in variability between the population and fraternal twins (expressed as the ratio between the respective standard deviations), one may calculate the margin of uncertainty in applying the results for twins to the general population. Such a calculation shows that the margin of uncertainty is not very great and that the ratios between genetic and nongenetic variations calculated for the twin group may be applied to the general population.

Does the investigation provide any information of value to the planning and prognosis of therapeutic attempts to change, for example, the sagittal apical base relation? The answer to this question is dependent to some extent on whether or not it may be accepted that nongenetically determined deviations in this relation are easier to treat than genetic deviations. From the theoretical aspect, it seems probable that the prognosis for treatment leading to a reduction of the difference between phenotype and genotype is better than for treatment that implies an attempt to increase this difference. These considerations are of little practical significance, however, as long as the genotype for the facial skeleton cannot be determined with a reasonable degree of certainty, but they may serve to explain, in part, the different responses to treatment displayed by patients with morphologically similar deviations in the sagittal jaw relations.

In postnormal occlusion the following signs may, perhaps, indicate a fairly normal genotype from the viewpoint of occlusion:

1. *Prolonged finger-sucking,* especially if it is the anterior region that is principally involved by the deformity, the molar occlusion being only slightly affected, with the result that the malocclusion may be ascribed with reasonable certainty to the finger-sucking.

2. *A fairly normal relation between the upper and lower jaws in the rest position, but incorrect occlusal position through cuspal interference.*

In prenormal occlusion the signs under the second item may be indicative of fairly normal genotype, although the direction of the displacement of the dental arches and the effect of cuspal interference are here the reverse.

The results seem to indicate that genetic factors have between one and two times the significance of nongenetic factors in respect to the variability in the characteristics investigated. These results seem to be valid, not only for twins but also for the population as a whole.

L'Ortopedia dell' Organo della Masticazione. (Orthopedics of the Masticatory Organs). First Edition. By Oscar Hoffer, M.D., University of Milan, Director of the Department of Maxillofacial Orthopedics in the Italian stomatological Institute. Milan, 1949, Casa Editrice Rodolfo Malfasi.

This book, written in Italian, sets forth the development of the eruption and occlusion of the teeth. In this respect, it follows to some extent the writings of Korkhaus and A. M. Schwarz. Under "Etiology," hereditary factors are discussed in some detail, as are intrinsic and extrinsic factors. Perverted oromuscular function is given as one of the important causes of malocclusion.

Cephalometrics is presented in accordance with the findings of the Italian school as well as those of the German authors. No reference is made to the work in cephalometrics in the United States or in the Scandinavian countries.

Part II is devoted to orthodontic appliances. The labial arch, as used by Izard, Reichenbach, and de Coster, is presented. The Johnson appliance is mentioned in passing. The use of removable appliances is given extended discussion. The activator appliance is discussed and illustrated in great detail and Häupl's histologic findings following the use of the activator appliance are discussed. References to the work of American authors in the field are conspicuous by their absence. J. A. S.

News and Notes

1956 Prize Essay Contest, American Association of Orthodontists

Eligibility.—Any member of the American Association of Orthodontists and any person affiliated with a recognized institution in the field of dentistry or associated with it as a teacher, researcher, undergraduate, or graduate student shall be eligible to enter the competition.

Character of Essay.—Each essay submitted must represent an original investigation and contain some new significant material of value to the art and science of orthodontics.

Prize.—A cash prize of $500.00 is offered for the essay judged to be the winner. The committee, however, reserves the right to omit the award if, in its judgment, none of the entries is considered to be worthy. Honorable mention will be awarded to those authors taking second and third places. The first three papers will become the property of the American Association of Orthodontists and will be published. All other essays will be returned.

Specifications.—All essays must be in English, typewritten on 8½ by 11 inch white paper, double spaced with at least 1 inch margins. Each sheet must be numbered and bound or assembled with paper fasteners in a "brief cover" for easy handling. Three complete copies of each essay, including all illustrations, tables, and bibliography, must be submitted. The name and address of the author must not appear in the essay. For purpose of identification, the author's name, together with a brief biographical sketch which sets forth his or her dental and/or orthodontic training, present activity, and status (practitioner, teacher, student, research worker, etc.) should be typed on a separate sheet of paper and enclosed in a sealed envelope. The envelope should carry the title of the essay.

Presentation.—The author of the winning essay will be invited to present it at the meeting of the American Association of Orthodontists to be held at the Statler Hotel, Boston, Massachusetts, the week of April 29, 1956.

Judges.—The entries will be judged by the Research Committee of the American Association of Orthodontists.

Final Submission Date.—No essay will be considered for this competition unless received in triplicate on or before Jan. 10, 1956, by Dr. Thomas D. Speidel, University of Minnesota, School of Dentistry, Minneapolis 14, Minnesota.

H. I. Margolis, Chairman, Research Committee
American Association of Orthodontists
311 Commonwealth Ave.
Boston 15, Massachusetts

American Association of Orthodontists, 1956 Research Section Meeting

Continuing the policy of recent years, the program will consist of a series of ten-minute research reports which may be presented orally or read by title only. All persons engaged in research are urged to participate in this program, which will be held on April 29 and 30 and May 1 and 2, 1956, in the Statler Hotel, Boston, Massachusetts.

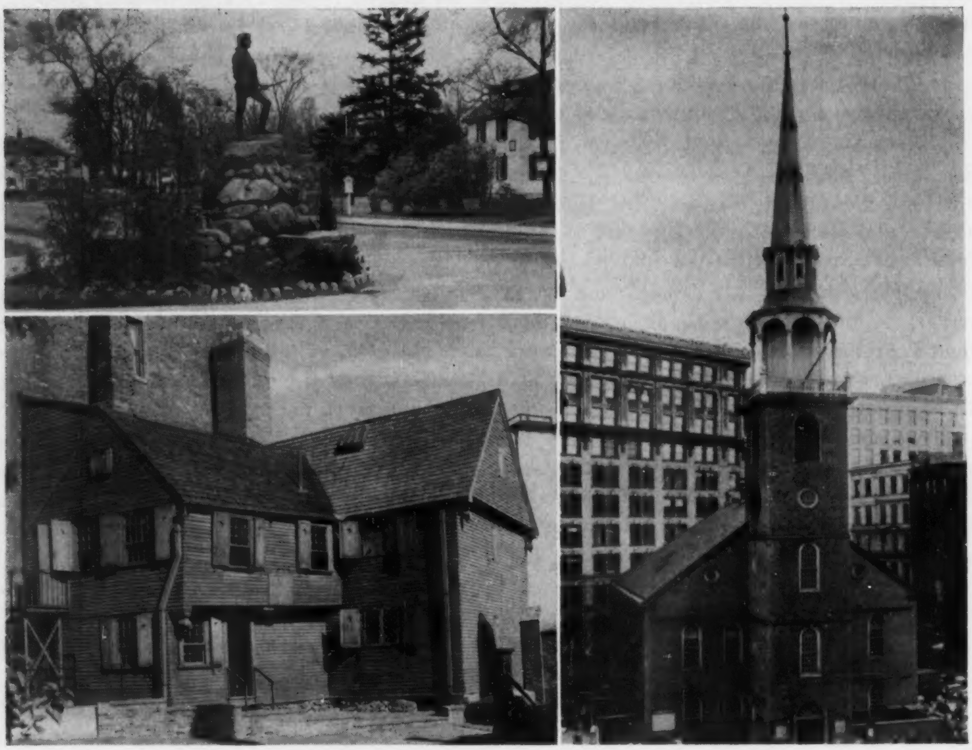
Each participant is asked to prepare a 250-word abstract for publication in the AMERICAN JOURNAL OF ORTHODONTICS. Abstract for publication and the ten-minute oral

presentation at the meeting should be carefully prepared to present an adequate description of the import of your investigation.

Forms for use in submitting the title and 250-word abstract of your research will be sent to each dental school orthodontic department and to any individual requesting one. Please send your title and abstract as early as possible, but not later than Jan. 10, 1956, to Dr. J. William Adams, 707 Bankers Trust Bldg., Indianapolis 4, Indiana.

H. I. Margolis, Chairman, Research Committee
American Association of Orthodontists
311 Commonwealth Ave.
Boston 15, Massachusetts

A.



B. *C.*

Historic points of interest to be seen by A. A. O. members, their wives, and guests who attend the 1956 annual meeting in Boston, April 29 through May 3.

A, The Battle Green, in Lexington, Massachusetts, known in history as the "Birthplace of American Liberty," where, on April 19, 1775, seventy-five Minute Men under Captain Parker met 400 of Major Pitcairn's regulars and heard the now-famous command, "Stand your ground; don't fire unless fired upon, but if they mean to have a war, let it begin here."

B, Paul Revere's house, the oldest wooden house in Boston, was built in 1660. Ancient wallpaper, tremendous fireplaces, and other features of the colonial period make this historical shrine a favorite stopping place along Boston's famous Freedom Trail.

C, Old South Meeting House, where, at a meeting on Nov. 29, 1773, 5,000 citizens resolved that tea should not be landed. It was from the doors of this building that the citizens, disguised as savages, led the way to the tea ships and the famous Boston Tea Party.

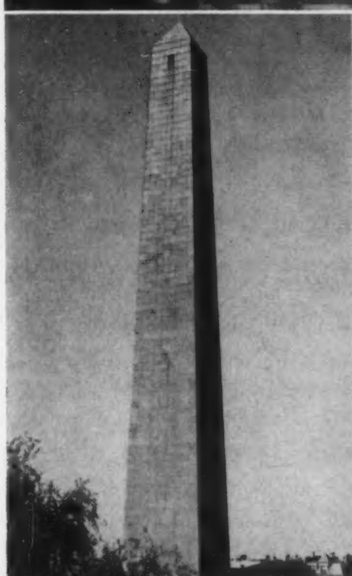
American Board of Orthodontics

The next meeting of the American Board of Orthodontics will be held at the Statler Hotel in Boston, Massachusetts, April 24 through April 28, 1956. Orthodontists who desire

to be certified by the Board may obtain application blanks from the secretary, Dr. Wendell L. Wylie, University of California School of Dentistry, The Medical Center, San Francisco 22, California.

Applications for acceptance at the Boston meeting, leading to stipulation of examination requirements for the following year, must be filed before March 1, 1956. To be eligible, an applicant must have been an active member of the American Association of Orthodontists for at least three years.

A.



B. *C.*

A, Gold-domed capitol of the Commonwealth of Massachusetts, located on Beacon Hill overlooking the famed Boston Common and Public Garden. This structure, the work of architect Charles Bulfinch, was occupied for the first time on Jan. 11, 1778.

B, Bunker Hill Monument in Charleston where, on July 12, 1775, General George Putnam gave the command, "Don't fire until you see the whites of their eyes." This 200-foot monument was completed in 1842 to commemorate the historic battle of the American Revolution.

C, Minute Man statue in nearby Concord, where was fired the "shot heard round the world."

Rules Governing Visitors to the 1956 Meeting of the American Association of Orthodontists April 29 through May 3, 1956, Hotel Statler, Boston, Mass.

To insure full participation of all members, it is necessary to limit attendance to fully privileged members of the American Association of Orthodontists and the following:

A. *No attendance fee.*

1. Full-time teachers in university dental schools.

2. Full-time graduate or postgraduate students in university orthodontic departments.

3. Dentists from outside Canada or the United States of America who are members of recognized dental or orthodontic organizations.

B. *Attendance fee $10.00.*

1. Associate or junior members of constituent societies of the American Association of Orthodontists.

2. Recent graduates of university orthodontic departments who are in service.

C. *Attendance fee $20.00.*

1. Recent graduates of university orthodontic departments who are not members of constituent societies of the American Association of Orthodontists.

2. Other guests certified by the Credentials Committee.

Those desiring to attend the meeting who qualify under the catagories listed above should contact the chairman of the Credentials Committee for approval of their credentials.

Credentials Committee,
RAYMOND M. CURTNER
FREDERICK B. LEHMAN
ABIJAH PIERCE, Chairman
58 Federal St., Greenfield, Massachusetts.

Pacific Coast Society of Orthodontists

The Northern component meets on the second Tuesday of March, June, September, and December.

The Central component meets on the second Tuesday of March, June, September, and December.

The Southern component meets on the second Friday of March, June, September, and December.

Seattle Meeting.—The Benjamin Franklin Hotel, which has been designated as Seattle's convention hotel, will be the site of the next meeting of the Pacific Coast Society of Orthodontists, which will be held Aug. 13-15, 1956. Inasmuch as the meeting will immediately follow Seattle's annual Seafair celebration, it is imperative that those who desire to arrive earlier than Aug. 12, 1956, make their reservations within the next three months.

Northern Component.—The regular meeting was held in room B-209, Health Sciences Bldg., University of Washington, Seattle, on Oct. 31, 1955.

Central Component.—The December meeting and annual Christmas party were held Dec. 13, 1955, at the Fraternity Club. Fifty members and guests enjoyed an early cocktail hour, a visit from Santa Claus, and a beautifully prepared motion picture entitled ''Surgical Aids in Orthodontics'' by Lyall Bishop, Walnut Creek oral surgeon, who narrated and discussed the various problems illustrated by the film.

The following officers were elected:

Chairman, Arnold W. Wieser
Secretary-treasurer, Eugene E. West
Program Chairman, Oliver E. Hartman
Director to P.C.S.O., Wendell L. Wylie

Southern Component.—The meeting was called to order by Chairman J. Clifford Willcox, on Dec. 8, 1955, at the Huntington-Sheraton Hotel. The social hour and dinner preceded the business meeting. Minutes of the September meeting were approved as published in the *Bulletin.* Officers' and committee reports were made. These included:

Treasurer, Bob Lee
Membership Committee, Bob Whitney
Hospital Committee, Roscoe Keedy
Nominating Committee, Herb Shannon

Officers for the year 1956 are:

Chairman, Cal Garverick
Secretary, Bob Lee
Treasurer, Burton Fletcher

The guest speaker was Dr. William Adams of the University of Indiana. His subject, "Attaining Important Orthodontic Objectives With an Efficient Finishing Procedure," was well presented and provided an interesting evening for the large attendance.

Denver Dental Association

The Denver Dental Association, at its regular meeting on Feb. 16, 1956, held a panel discussion on orthodontics. This represented an honest effort by the members of the Rocky Mountain Society of Orthodontists to discuss orthodontic problems and to answer questions which are most frequently asked by family dentists in a survey recently conducted in the Rocky Mountain region.

For several years the Rocky Mountain Society of Orthodontists has been studying a logical approach to the problem of supplying orthodontic service to outlying areas where this service is not available. This orthodontic panel program was one result of this planning.

National Alumni Association of The Baltimore College of Dental Surgery Confers Honor on Dr. George Anderson

The Baltimore College of Dental Surgery presented an award to the man selected as its most distinguished alumnus at a dinner given in Baltimore on March 1, 1956. The honor was conferred upon Dr. George M. Anderson, orthodontist of Baltimore, in recognition of his many contributions to dentistry and to his specialty, orthodontics.

Dr. Anderson was not only connected with the Baltimore College as a technician for many years and head of the Orthodontic Department, but he has been the author of many scientific manuscripts and a number of editions of the well-known and traditional Dewey-Anderson textbook, *Practical Orthodontics.*

The record of Dr. Anderson's contributions over a long period of years is indeed impressive, and this energetic and talented orthodontist was chosen by a committee chosen for that purpose by the National Alumni Association of the Baltimore school.

University of Pittsburgh

The Graduate School of the University of Pittsburgh announces that selections of students for the graduate class in orthodontics will be made in March, 1956.

Further information and applications for admission may be obtained by writing to The Director of Graduate Education, University of Pittsburgh, School of Dentistry, Pittsburgh 13, Pennsylvania.

Washington University

Washington University School of Dentistry, St. Louis, Missouri, announces a postgraduate course in labiolingual technique to be held at the School of Dentistry, March 18 to 24, 1956. The course will be under the direction of Dr. Oren A. Oliver and staff.

Eastman Dental Dispensary

The Eastman Dental Dispensary in Rochester, New York, announces a postgraduate course in orthodontics. The course, beginning in September, will be eighteen months to two years in duration. Candidates for an advanced degree in dentistry must enroll in the two-year program; supplementary course work will be offered at the University of Rochester, School of Medicine and Dentistry.

Five graduate dentists will be accepted each September. Applications will be received up to June 1.

Further information and application forms may be obtained from Basil G. Bibby, Director, Eastman Dental Dispensary, Rochester 3, New York.

University of Pennsylvania

The University of Pennsylvania announces a postgraduate course entitled "The Twin Wire Mechanism." The course, taught by Dr. Joseph E. Johnson, will be given June 4 to 8, 1956. It is an advanced course for dentists who are engaged in the practice of orthodontics. All applicants should be members of sectional societies of the American Association of Orthodontists or hold certificates from a recognized graduate course in orthodontics.

Oklahoma State Orthodontists Society

The Oklahoma State Orthodontists Society held its regular meeting Feb. 26 and 27, 1956, at the Skirvin Hotel, Oklahoma City, Oklahoma. The meeting featured a round-table discussion of common problems, participated in by the members. The officers of the society are: *President,* Harry Sorrels; and *Secretary,* Bob Knarr.

The following program was on the agenda:

1. Time for Orthodontic Treatment. Phil Caudle.
2. Preventive Orthodontics. Ben Caudle.
3. Problems of Musical Instruments. George Webber.
4. Problems of the Transitional Stage of Development. John Lewis.
5. Open-Bites—Cause and Cure. Wm. N. Flesher.
6. Cross-bites—Cause and Cure. George Mindeman.
7. Problems of Patient and Parent Education. Sumner Russman.
8. Problems of Public Relations. Sumner Russman.
9. Problems of Orthodontic Mechanics. Harold Born.
10. Third Molars—Impactions. Hugh Sims.

University of California

The University of California presented a refresher course in orthodontics, "Treatment of the Mixed Dentition," by B. F. Dewel, Evanston, Illinois, George W. Hahn, J. Rodney Mathews, and William W. Paden, on Feb. 18 and 19, 1956.

University of Alabama

A three-day refresher course in removable orthodontic appliance construction was presented Feb. 25, 26, and 27, 1956, under the direction of Samuel D. Gore, D.D.S., of New Orleans, Louisiana.

First Dental Education Workshop

The First Dental Education Workshop will be held at the Hotel Statler, New York City, on Friday, April 20, 1956. The theme of the one-day conference is "Professional Education of Dentists for Tomorrow."

The Workshop is held in connection with the program of the First District Dental Society of New York, Alfred J. Asgis, Director.

Italian Society of Stomatology

The meeting of the Italian Society of Stomatology will take place in Florence, Italy, Sept. 24 to 29, 1956. Papers will be presented on the following subjects:

Up-to-Date Views on Oral Liquids. Prof. R. Bandettini.

Precocious Diagnosis and Therapy in Dental and Facial Orthopedics (Subject of the Social Dentistry). Prof. A. Maggioni.

Materials and Techniques for Taking Impressions. Prof. G. Pejrone.

For further information, write to the Congress Secretariate, 25 Via San Gallo, Florence, Italy.

Notes of Interest

Dr. Hubert J. Bell, Jr., announces the removal of his office from 223 Physicians Bldg. to 116-117, Physicians Bldg., Boulder, Colorado, practice limited to orthodontics.

John David Callahan, D.D.S., M.S., announces the opening of his office at 512-13 Wilson Bldg., Syracuse, New York, practice limited to orthodontics.

Samuel D. Donson, D.D.S., announces the opening of his offices at 150 Hartsdale Ave., Hartsdale, New York, and 253 South Broadway, Tarrytown, New York, practice limited to orthodontics.

Arthur Fourment, D.D.S., announces the opening of his office at 133 Leggett Dr., Abilene, Texas, practice limited to orthodontics.

Drs. Nathan G. Gaston and Billie G. West announce the removal of their offices on March 1, 1956, to 701 Walnut St., Monroe, Louisiana, practice limited to orthodontics.

Bernard E. Gruber, D.M.D., announces the removal of his Long Island office to 275 Middle Neck Road, Great Neck, New York, practice limited to orthodontics.

Samuel N. Knopf, D.D.S., announces his location at 33 West 42nd St., New York, N. Y., practice limited to orthodontics.

Dr. Seymour Levin announces the removal of his office to Five Hooker Ave., Poughkeepsie, New York, practice limited to orthodontics.

Jack M. Resnick, D.D.S., announces the removal of his office to 40 Maple St., Springfield, Massachusetts, practice limited to orthodontics.

Leonard T. Walsh, D.D.S., and Donald J. Ullstrom, D.D.S., announce the formation of a partnership, with office at 442 Thatcher Bldg., Pueblo, Colorado, practice limited to orthodontics.

OFFICERS OF ORTHODONTIC SOCIETIES

THE AMERICAN JOURNAL OF ORTHODONTICS is the official publication of the American Association of Orthodontists and the following component societies. The editorial board of the AMERICAN JOURNAL OF ORTHODONTICS is composed of a representative of each one of the component societies of the American Association of Orthodontists.

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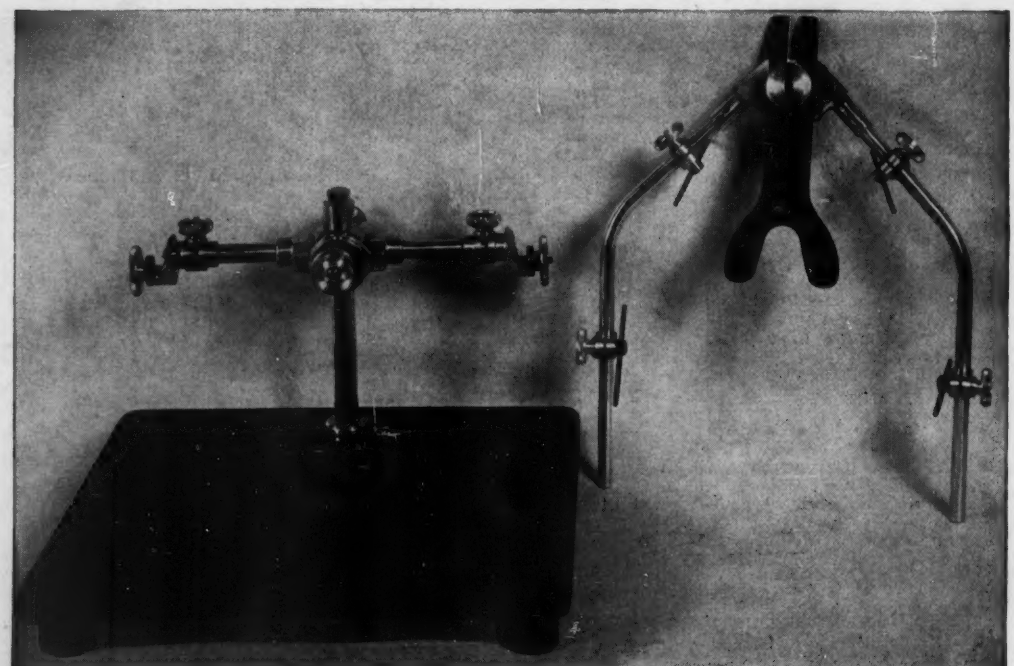

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